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Automotive Service Methods and Equipment

I. Tools and Methods in Use at New York Packard Service Plant—Testing Fixtures—Special Reamers and Other Tools—"Maximum Estimate" System

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Western Editor, *American Machinist*

WHILE the problem of manufacturing automobiles, both cars and trucks, presents a manufacturing problem which is taken care of when the best equipment available is either purchased or built and installed, the repairing or "servicing" of these cars and trucks presents an entirely different problem. Not only are the repairs which have to be made never-ending in variety, many calling for special treatment, but the equipment for taking care of these repairs must be adaptable for use on as many different kinds of units as possible, on as many different kinds of work as possible, and take up as little room as possible. Consequently, a number of ingenious tools and fixtures have been developed for doing the various jobs which are peculiar to service work.

Re-boring Valve Seats

The service station of the Packard Motor Car Co., at Long Island City, N. Y., includes in its equipment a number of interesting and efficient tools, one of which is for the re-boring of valve seats in cylinders. At *A* in Fig. 1 is the roughing tool for valve-seating Twin-Six cylinders. The long pilot is inserted in the valve stem hole and the tool is turned with a tap-wrench. The tool is made with a single blade, ground to cut at both ends. The finishing tool *B* is an eighteen-blade cutter and is turned by hand, as only a fine cut is taken at the finish. At *C* is shown the tool used for re-seating the valves in truck motors. This is also a multi-blade tool, and is so designed that mechanical pressure may be applied, thus making for uniform pressure on

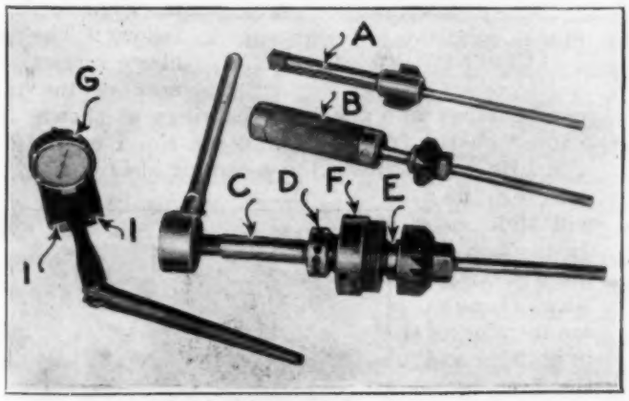


FIG. 1. MISCELLANEOUS SERVICE TOOLS

all blades, and relieving the operator from the strain of bearing down on the tool with his weight. The method of feeding the tool is as follows:

The shank of the tool passes through the part *D* which is threaded and screws into the part *F*, resting against the shoulder *E*. Part *F* screws into the valve plug hole. Thus it will be seen that in order to set

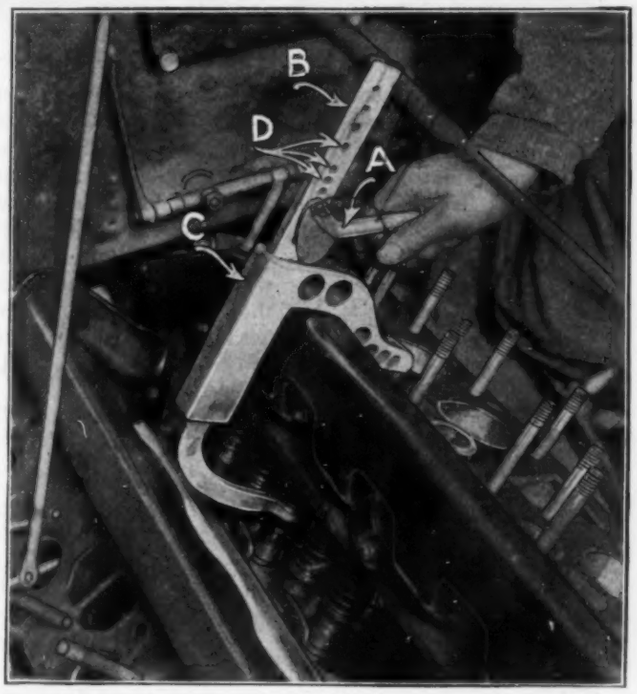


FIG. 2. TOOL FOR ASSEMBLING VALVE SPRINGS TO MOTORS

the tool the pilot is first inserted in the valve stem hole with the tool resting in the valve seat. Then part *F* is screwed into the valve plug hole and part *D* is screwed into part *F* until the end rests against the shoulder *E* as shown. The tool is fed down, as required, by screwing part *D* farther down into *F*. The tool is turned with a ratchet wrench which may be used either way.

At *G* in Fig. 1 is shown a dial indicator for gaging cylinder bores. The indicator is fastened to a block which has a bearing at *II*, this bearing being turned to the radius of the cylinder bores. Upon being slid into the cylinder bore, the dial registers 0 if the cylinder is exactly to size, the oversize and undersize spots registering in thousandths of an inch on the dial, which is so turned that it can be easily seen by the operator.

In Fig. 2 is shown a device for lifting valve-springs and holding them while the operator either assembles or removes the collar and pin which holds the spring

FIG. 3. CONNECTING ROD TEST FIXTURES

in place. The operation of this tool is obvious. When the handle of the cam lever *A* is parallel with the part *B* to which it is attached, the part *C* has room to slide far enough so that the tool may be placed in position as shown. The lower end of *B* is forked so that it will engage the end of the spring on either side of the valve stem. After being placed in position the cam lever *A* is forced down as shown in the illustration, compressing the spring and holding it until released. The tool can be adjusted to fit different sizes of cylinders by pinning the cam lever through any one of the several holes shown at *D*.

Gaging Connecting Rods For Re-alignment

Fig. 3 shows a gage used for determining the amount of straightening necessary to re-align the connecting rod. Part *A*, which is relieved to fit over the parts assembled to the top of the crankcase, rests on the top of the crankcase and the crankshaft is turned so that the piston protrudes as far as possible. A clearance of $\frac{1}{64}$ in. is provided at either side of the piston, which is just enough so that if the piston is not in perfect alignment, it can be seen immediately and the usual method of straightening applied.

The last operation in the fitting of a new crankshaft bearing in a connecting rod is that of reaming the bearing to size. This is done with the fixture shown in Fig. 4. The bearings usually have about 0.030 in. of metal to be removed, although this varies with the size of the crankshaft to which the rod is to be assembled. Therefore the crankshaft is gaged with the micrometer, and the reamer, which is adjustable, set to size accordingly. The pin through the small end on the rod holds the rod to the correct center distance and assures that the two holes will be parallel. The fixture is held in a vise on the bench and the reamer is turned with a wrench.

Align Reaming Main Bearings

Frequently a crankcase has to be fitted with a complete new set of main bearings. These bearings contain about $\frac{1}{16}$ in. of metal that has to be reamed out and all of the bearings have to be reamed in line. Not only this, but frequently they have to be reamed out of the original center in order to bring the gear centers in correct relation to each other, due to the wearing of the gears or bearings, or the replacement of a gear with a new one. The tool used for this operation is the Martell reamer, a commercial article of unique design, shown in Fig. 5. The alignment of the reamer bar *A* is obtained by means of several supporting bushings *B*, each consisting of two eccentric bushings held in a conical sleeve, the conical portion of which is provided with a fine pitch thread as shown at *A* in Fig. 6. These conical sleeves are screwed into the soft metal of the bearings to be reamed and the eccentric bushings adjusted until the reamer bar is in the desired position and perfectly aligned through all bearings. Then the reamer head is clamped at the desired location on the reamer bar and the bearings are reamed, one at a time, always keeping at least two of the conical sleeves in place to support the reamer bar. The eccentric bushings are controlled by the flanges *B* (Fig. 6), which is the outer bushing, and *C* which is the inner bushing. A vernier graduation on the faces of the flanges shows in thousandths of an inch the relation of the reamer bar to the bore of the conical sleeve. The screws *D* are lock screws which hold the bushings in place after setting. The reamer is secured to the shaft by the clamping nut shown at *C* in Fig. 5, which screws on to the tapered end of the reamer head. The reamer head is slotted lengthwise of the tapered and threaded portion, so that it compresses as the clamping nut is screwed on. Thus the reamer can be firmly fixed at any place desired on the shaft. The operation of reaming out the bearings, as shown in Fig. 5, is as follows: The operator screws the nose of the three cone bushings into the three bearings as shown, Nos. 2 and 3 on the front side, and the No. 1 on the back side. He then adjusts the eccentric sleeves until the reamer bar will slide easily through all three bushings. The sleeves are then locked in position and the first bearing reamed, being guided by bushing No. 1. By the time the reamer is far enough

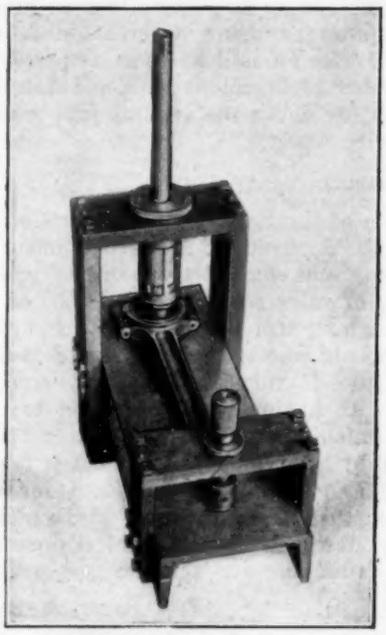


FIG. 4. REAMING FIXTURE FOR CONNECTING RODS

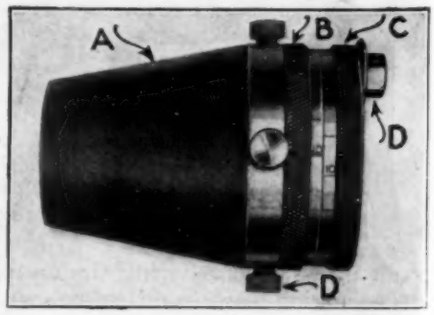


FIG. 6. CONICAL SLEEVE USED ON MARTELL REAMER

through to strike the bushing, it is in far enough to guide itself and the bushing can be removed. The same process is then followed on the other bearings, the reamer shaft always being kept in alignment by cone bushings in all bearings excepting where the reamer is working. By this method a complete set of bearings can be reamed so as to shift the center in any direction desired, thus making it possible to change the relation of gear centers, etc. The reamer is of the inserted blade type, the blades being expanded by means of adjusting nuts at either end which act on tapered cams.

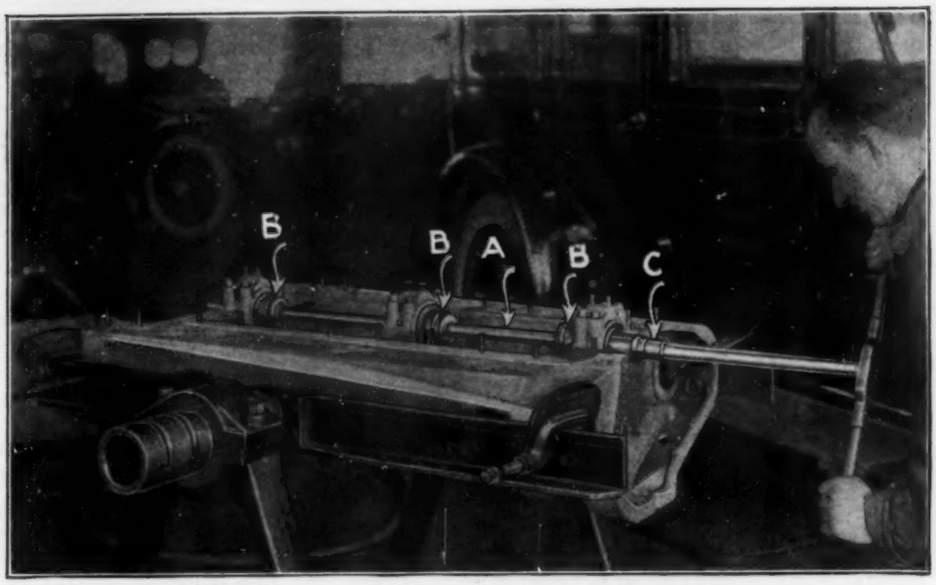


FIG. 5. ALIGN-REAMING MAIN BEARINGS

A tool that is almost indispensable in the service station is the gap lathe, one of which is shown in Fig. 7. In this instance the operator is boring out a brake drum which could not be swung in a medium-sized lathe of the usual type. The gap lathe will handle work that otherwise would require a very large lathe, expensive as to cost, requiring a greater amount of power and occupying room which could often be used to much better advantage in other ways.

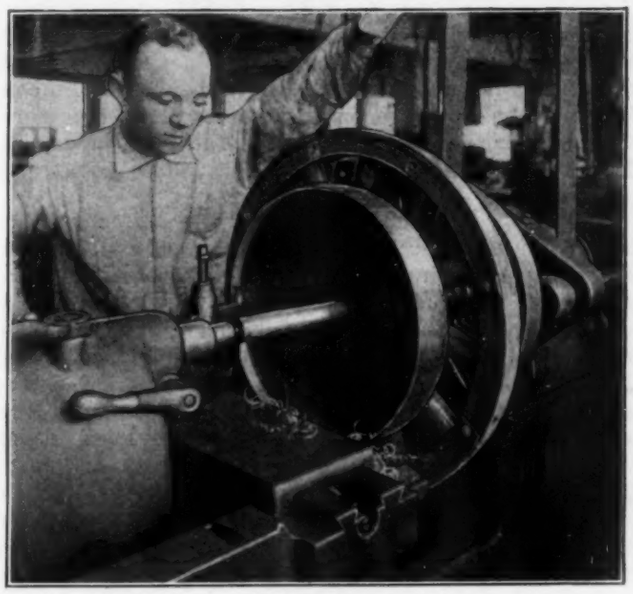


FIG. 7. THE GAP LATHE IN SERVICE WORK

Eliminating Play in Steering Gear

An ingenious method of eliminating play in the steering gear is shown in Fig. 8. Some of the older types of Packard cars were so designed that no provision was made for this contingency, with the result that the service men had to devise a method of correcting the evil. At *A* is shown the steering gear shaft on which a spiral thread is cut at *B*, running through the bronze nut *C*. The action of turning the shaft causes the nut to traverse the length of the spiral, turning the shaft *D*. At *E* is shown a series of collars cut on the shaft with corresponding grooves cut in the bronze steering gear case. These collars and grooves were designed to take the thrust caused by the turning of the shaft in the nut, with the result that the grooves wear, allowing the shaft to "shuck" up and down in the case. This wear is taken up in the following manner: The shaft is turned about $\frac{1}{32}$ in. undersize at *F*, and a collar *G* is made, being $1\frac{1}{8}$ in. O. D. and bored just large enough to slip over the shaft. Then it is threaded, 16 threads to the inch, and grooves are milled in it lengthwise as shown. It is then slipped on to the shaft and brazed in the position shown, leaving just enough room for the thrust bearing *H*, which consists of two brass thrust washers and a steel ball retainer.

A collar or nut *I* is now made, threaded inside to fit the part *G*, and having slots milled lengthwise on the outside so that it may be turned with the aid of a screwdriver. Several holes are drilled in it, all being in a circle equi-distant from the end and about half an inch apart. A spring *J* is made, having a pin in one end which fits into one of these holes. The thrust bearing is now put on to the shaft and the nut *I* is screwed on to the part *G* until it is quite tight against the thrust bearing, the spring *J* being slipped on to the nut so that the pin projects through one of the holes and into one of the slots in the collar *G*. Thus the

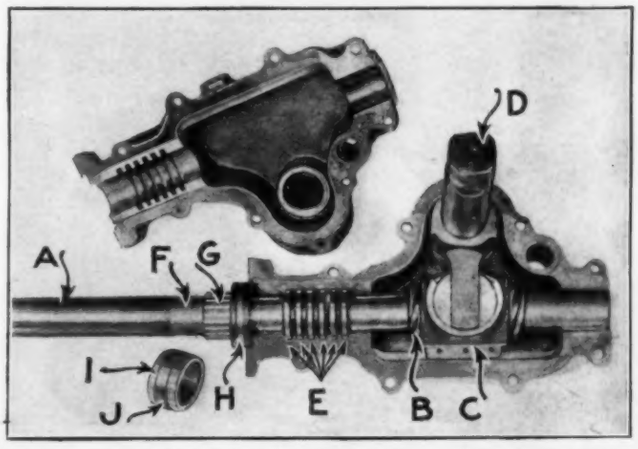


FIG. 8. STEERING GEAR WITH "HOME-MADE" ADJUSTING NUT TO ELIMINATE PLAY

wear is all taken up in one direction and as fast as the mechanism wears appreciably the spring-pin is pried out of the hole, the nut is given part of a turn with

FIG. 9. CUTTING OFF A STEEL FRAME WITH THE ACETYLENE TORCH

a screwdriver or other tool, and the spring pin is slipped into a hole again, engaging a slot in the collar and preventing the nut from working either way. As can be seen, the slots are quite close together, but more than one hole is drilled in the nut to insure having at least one pin-hole over a slot.

Cutting Off A Frame

The use of the acetylene torch to cut off a steel truck frame is shown in Fig. 9. In this instance the purchaser of the truck intended to fit it with a special dump-body, which required a shorter frame than the one furnished, so the frame was cut off to the desired length and the usual end section riveted on. The layout man marks off the place where the frame is to be cut, then the torch operator clamps a steel block to the frame with one edge of the block parallel to and resting on the line. This is to guide the "nose" of his torch, as the line cannot be seen when the torch is burning. A complete frame, which is of 7-in. angle steel, can be cut off in less than ten minutes. After the piece has been severed from the frame, the operator

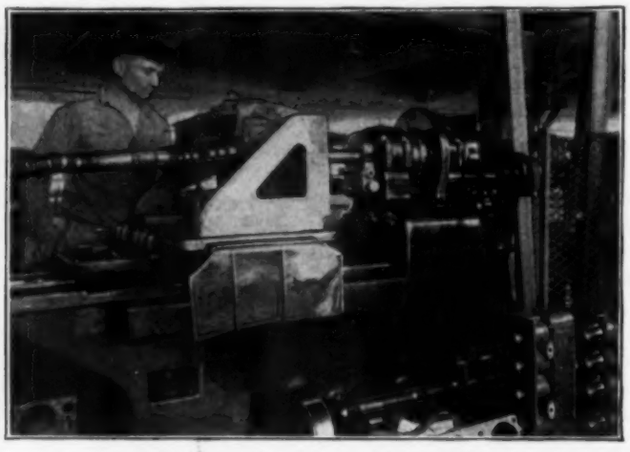


FIG. 10. GRINDING CYLINDER BORES

trims the edge of the section with the torch, making the edge fairly smooth and ready for the end piece to be riveted on.

Cylinders that are badly worn or "scored" are ground oversize and fitted with pistons ground for this purpose. The oversize dimensions are 0.020 and 0.040 in. larger than the standard size of the cylinder. Pistons supplied from the factory for service work are ground to these sizes. The fixture used for holding the cylinder while it is being ground, is a large angle plate as shown at *A* in Fig. 10. The front of the fixture has openings so that the spindle of the grinder can be inserted into the cylinder bore, and the block is located on pins by the same holes by which it was located when the bores were originally bored and ground. The cylinder is clamped to the fixture in the position shown, resting on jacks, one of which shows at *B*. At *C* is shown a set of six locating blocks or stops which save time in locating the cylinder for the various bores. Each block is about an inch wide, and has a line across the center of it, parallel with the spindle of the machine. On the table of the machine at *D* is a stationary perpendicular block bearing a similar line. When the table is shifted so that the line on any one of the blocks *C* coincides with the line on block *D*, one bore is exactly central with the spindle. Thus no time is lost in lining up the different bores with the spindle.

"Maximum Estimate" System

A unique feature of Packard service is that of giving the customer a maximum estimate in advance on the cost of the work that is to be done. Every car owner has had the experience of taking his car to the repair

TABLE I. SHOWING LIST OF OPERATIONS AND PRICES

		Models				
Operation	2-38	3-38	4-5-48	1-25	2-25	3-25
1 Carbon valves, tune up	29.98	29.98	29.98	41.00	32.40	32.40
2 Rebored cyls.	260.29	263.65	265.12	326.27	316.34	316.34
3 Supply and attach new cyl. (2)	493.59	493.59	496.77	562.11	563.61	563.61
4 Supply and attach new cyl. (1)	261.13	261.68	280.77	308.74	316.27	316.27
5 Rebored cyls. (off car) exchange and fitted.	.....	.....	131.98	162.50	162.50	162.50
6 Rebored cyls. (off car) exchange, no fitting	78.00	78.00	78.00	96.00	96.00	96.00
7 Replace chain	.....	.....	.....	31.41	26.41	26.41
8 Tighten chain only	.....	.....	.....	14.66	1.00	1.00
9 Tighten chain and retime	.....	.....	.....	15.66	9.22	9.22
10 Scrape carbon and tune up	14.05	14.05	14.05	23.50	25.22	25.22

shop assuming that certain repairs which are obvious to him are all that are needed to put the car in first-class shape. Frequently, the workman or inspector discovers that the job requires a great deal more time and material than was apparent, with the result that the customer is both surprised and dissatisfied with the amount of his bill.

Under the Packard system, the amount of labor and material necessary for each individual operation has been carefully recorded and the cost figured, so that an estimate of the cost of his service can be furnished to the car-owner before the work is started. If he specifies that certain labor be performed, such as taking up the bearings, or adjusting the brakes, he is told immediately what the maximum cost is for this job. If he wants the motor overhauled or asks that the car be "put in good condition," an inspection is made at once, the various requirements noted and a maximum estimated cost is rendered. This estimate may not be the actual cost, because if less time or material is required than the estimate called for, the customer is given the benefit of the saving, while if it exceeds the estimate, the company stands the loss.

Every definite operation in car repairing is numbered and recorded together with the estimated cost of the operation as applied to each model of car or truck.

OPERATION No.	NAME OF OPERATION	MODELS COVERED BY THIS OPERATION
1	Carbon, Valves and tune up.	2-3-35

ESTIMATED PRICE 32.40

ANALYSIS OF OPERATION

See attached list

	PRICE CHANGED		PRICE CHANGED		PRICE CHANGED		CHECKED	
Date							Date	By
Material		2.79		4 40				
Shop Labor	12 Hrs. @	24.00	13 Hrs. @	26 00	Hrs. @	Hrs. @		
Test Labor	1 Hrs. @	2.00	1 Hrs. @	2 00	Hrs. @	Hrs. @		
Total		28.79		32 40				
Flat Price								

PIECE No.	QT	MATERIAL	TOTAL LIST PRICE	TOTAL LIST PRICE	TOTAL LIST PRICE	TOTAL LIST PRICE
42123	12	Spark Plugs gaskets	.40	40		
103929	2	Cyl. Head Gaskets	1.65	330		
67389	2	Intake manifold gaskets	.22	20		
67546	1	Carb. to Cyl. Gaskets	.17	17		
		Misc. Material	.34	33		
TOTAL			2.79	4.40		

TABLE II. OPERATION ANALYSIS CARD

One of these operation sheets is shown in Table I. Table II is an operation analysis card, on the front side of which (*A*) is recorded the name of the operation, the name of the parts required together with the number of pieces and Part No. of each, the number of hours of labor required, and the cost of both labor and materials, all of which comprise the estimated price of the job.

On the back side of the card (*B*) are listed all the various jobs that are included in this operation, so that the operation will always include the same amount of work and no part of the operation will be omitted. The customer may also know at once just what will be done to his car, as well as the maximum cost.

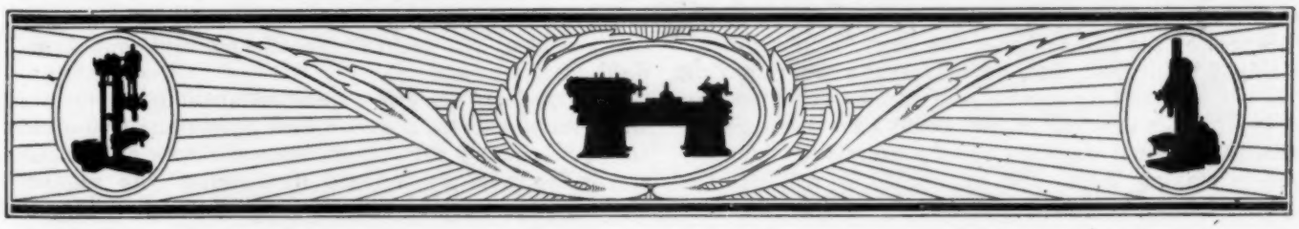
Auto Show at The Hague

Announcement is made that the same committee which organized and managed the successful automobile show at The Hague in April of the present year is to organize and manage a second show, which will be held from the 1st to the 15th of May, 1922, according to a report from Consul General Anderson, at Rotterdam. The show next spring will be held in the Kurhaus, at Scheveningen, the seaside resort near The Hague, and it will be arranged to have the leading hotels and cafés of the resort opened at the time. In connection with the show there will be an exhibition of airplanes and automobile boats with demonstrations. The temporary office of the secretary of the exposition has been established at No. 185 Spui, The Hague.

Electrical Developments in China

Four electrical undertakings, the *Far Eastern Review* reports, have recently been registered with the Chinese Ministry of Agriculture and Commerce, namely, the Shou-shing Telephone Co., Shou-shing, Chekiang; the Jui-An Electric Light Plant; Sui-an, Chekiang; the Chowshan Electric Co., Chowshan, Chekiang; and the Sun Fong Electric Co., Kiangsu. Other electric companies that have been organized are the Yau Tai Electric Light Co., at Tai Hsin, Kiangsu, and the Sing Yang Electric Light Co., of Sing Yang, Honan.

The same publication also states that Chen Yi-hee, president and organizer of the Sunning Railway, expects to organize a company with $2,000,000 capital to develop a water-power project near the town of Sunning. As was the case in the construction of the Sunning Railway, it is proposed to secure the money for this water-power enterprise from former residents of the Sunning district who are now living in the United States. As soon as the necessary capital has been fully subscribed, it is planned that contracts for the equipment will be placed immediately.



Notes on the Design of Shaving Tools

Blanked Pieces of Sheet Metal Have Rough Edges—Second Operation Necessary to Insure Accuracy of Size and Contour—Three General Classes of Shaving Tools

By HUGO F. PUSEP

THERE is no branch of the interchangeable system of manufacture, the development of which opens a wider field of possibilities to the tool engineer than that of punch press tools. The subject, however, is so vast that in order to approach it in a comprehensive manner one must limit himself to the discussion of one particular branch at a time.

Shaving dies present great possibilities in the way of reducing the cost of manufacture in certain specific lines, and are being taken advantage of more and more;

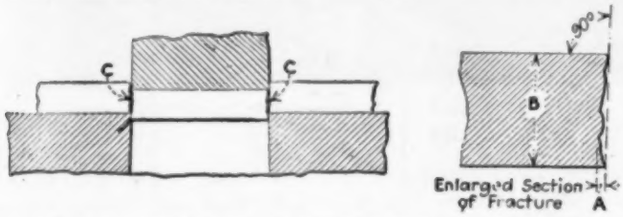


FIG. 1. ACTION OF BLANKING PUNCH AND DIE

but the field is yet comparatively new. Having in mind the immense advantages to be derived from a further application of the principle, I have in this article gone into the subject of shaving dies in a systematic manner, showing some of the principles upon which shaving die design is based. I have endeavored to make my sketches simple in order to bring out the main idea clearly at first glance. The table of shaving allowances worked out upon a "percentage thickness of stock" basis, is, to the best of my knowledge, the first attempt to present such material in a convenient form.

Purpose of the Shaving Die

The term "punch and die," in the ordinary sense of the expression, conveys to one the idea of a rather approximate sized hole or blank in sheet metal in which the accuracy of contour is left more or less to chance. That this is not the case is well known in certain specialized industries, such as the manufacture of typewriters, adding-machines, watches, etc., in which success depends upon the production to extremely close limits of a multitude of small, intricate parts of sheet metal.

This accuracy is made possible by that class of dies known as shaving dies. A shaving operation bears the same relation to the shaved blank as does the grinding operation to a rough-turned shaft. Both are intended to produce accuracy and finish in their respective fields.

The shaving die is a carefully designed and constructed set of tools made for the purpose of taking a finishing cut on the contour of a blank; either on the outer edges or in a pierced hole. This finishing cut takes the shape of a thin shaving in comparison to the thickness of the blank; hence the term "shaving dies." It might be argued that, as the results from shaving dies are obtained by careful and accurate construction of the tools, the same results could have been gotten from the original blanking dies by exercising the same care in making them. For answer let us consider the action of a blanking die.

The diagram in Fig. 1 serves to illustrate what takes place when a punch is being forced through a piece of sheet-metal stock against the edges of a blanking die. The pressure exerted by the punch is greater than the shearing strength of the stock; therefore a fracture occurs, corresponding in outline to the punch. The slug, or punching, continues to be pushed downward by the descending punch and is finally detached from the stock.

Edges of Parts From Blanking Die Are Torn and Uneven

If we now carefully examine the edges of this punching as shown in the enlarged section of the fracture we discover that they are comparatively rough and uneven. By drawing a line at 90 deg. from either surface of the blank it will be seen that the edges represent a series of depressions, some deeper than others, resembling in appearance a badly torn surface.

When two or more blanks of different thicknesses are examined and compared, we discover this interesting fact, that the thicker the stock being punched the rougher and deeper the imperfections around the contour of the blank. In other words, the depth *A* bears a definite relation to the thickness *B* of the blank.

We are thus enabled to see what takes place when the stock is giving away under the pressure of the punch. A fracture of metal occurs along the lines *C C* made uneven by the variation in the structure of the metal. As these uneven edges pass each other, they cause more tearing and displacement. The punch, in following the blank through the stock, will force in, or cut off, the higher projections, causing the hole in the stock to take the same size and outline as the punch. The blank being pushed through the die will take the outline and dimensions of the die for the same reason. That is the reason in a technical sense why the punch will govern the size of the hole and the die that of the blank.

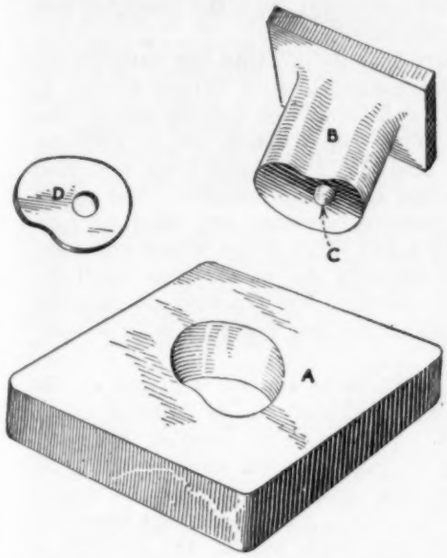
Sizes Obtained by Blanking Methods Not Dependable

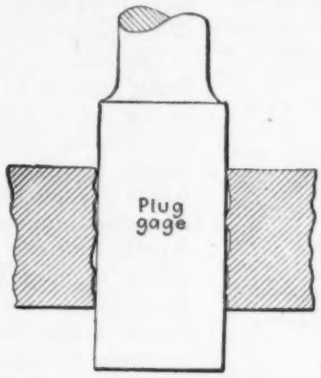
This, however, is true only in a general way, as will be seen on examining Fig. 2, where the plug gage is held in a punched hole by a number of uneven projections; only a small percentage of the surface of this hole being in contact with the periphery of the gage. Such a hole may be a good push fit for the gage at a first trial or so, but were the trial to be repeated a number of times the feel of the gage will become looser as the higher ridges around the circumference of the hole become smoothed by its passage. Were this hole to serve as a fulcrum point for some intricate mechanical movement the accuracy of the machine would, indeed, be short lived.

The modern designer specifies shaving operations wherever a smooth, accurate hole or contour is desired in a sheet-metal part. Any shape of hole or contour can be successfully finished by shaving. As regards limits in the thickness of stock for shaving, it is gen-

eral practice not to shave stock thinner than 0.020 in.; the break in stock up to this thickness usually being smooth enough for all practical purposes. On the other hand it is quite practical to shave stock $\frac{3}{8}$ in. thick. In many shops where shaving dies are now extensively used it had been the usual custom, if the blank was thicker than $\frac{1}{16}$ in., to ream all accurate holes and mill the particular parts of the outline to size. This practice is fast going out of favor—the shaving die taking the place of the reamer and milling cutter—resulting in the saving of thousands of dollars to the manufacturers.

Shaving dies may be roughly divided into two classes: Dies for shaving the blank all around; and dies for shaving only a part of the contour. Dies of the former class can be further subdivided into groups according to construction and the kind of service for which they are made. Thus we have the "push through" type; the "spring pad," and the "compound" shaving die.





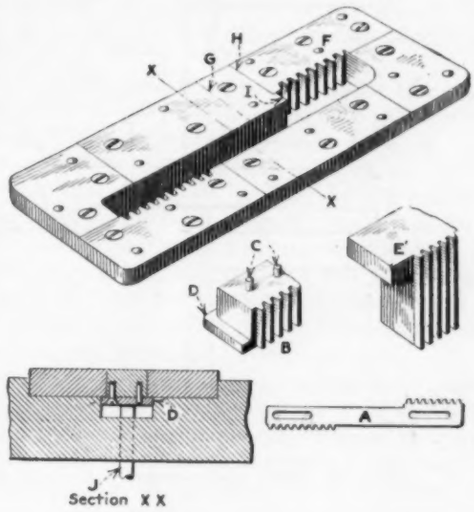


FIG. 2. (ABOVE) SHOWING INSUFFICIENCY OF BEARING SURFACE. FIG. 3. (LEFT) A COMMON FORM OF PUSH THROUGH DIE. FIG. 4. (RIGHT) THE SPRING-PAD TYPE OF SHAVING DIE

It is very often the case that a blank having a central hole that is not subject to wear, must have the periphery very smooth and accurate. A gear blank with a hub riveted into the central hole must have the teeth accurately formed. In this particular instance the hole in the center serves only for the reception of the hub and need not be shaved. This is where the push through type of shaving die can be used to advantage. The principal points in construction of such a die are shown in Fig. 3, and consist of the die *A*, the punch *B* and the pilot *C*. In this die the cam blank *D* is to be shaved all around.

The blank is located over the opening of the die by suitable locators and when the punch descends, the pilot *C* in entering the hole in the blank will line it up and push it into the die opening, shaving off the oversize allowance around the blank and leaving the contour of the cam smoothly finished and accurate to size. The next blank will push the one already in the die further down, and so on till the finished blanks begin to drop through the die at each stroke of the press.

There is only one objection to this type of shaving die, and it is that a slight amount of draft must be allowed in the die opening for the successful push through of the blanks. This feature will result in the blanks coming slightly oversize after a number of regrindings, and is the only point against this useful class of dies for very accurate work.

As will appear from the sketch, the construction of this die resembles closely that of a blanking die. These dies are very rapid in action, it being necessary only to insert the blanks, the push through feature taking care of the rest. As a general rule, however, this type of die is suitable only for such blanks as have a central hole and a comparatively symmetrical outline.

For long blanks that are to be shaved all around, the spring pad type of shaving die is often used. It is to be preferred to the push through type, as with it a greater degree of accuracy is attainable. The reason for this is that, as the blank is pushed up out of the die immediately after shaving, the sides of the die opening can be left perfectly square with the top and consequently no amount of regrinding will affect the size of the shaved blank.

In Fig. 4 is shown in perspective the top view of a spring pad shaving die for the rack shown at *A*. This view shows the die without the spring pad. As the rack blank is rather long, and also to facilitate cutting the teeth in the die, the latter is made up of several sections screwed and doweled to a cast-iron die-shoe. A pocket is milled out in the die-shoe for the sections to fit into as clearly shown in the section 20. There is also a deeper pocket provided at the center as a working space for the spring pad.

One end of the pressure pad is shown at *B* with two pins *C* to enter the slot at one end of the blank. A duplicate of this section being at the other end of the pressure pad, they thus serve to locate the blank by means of the slots. Other methods of locating a blank will be discussed later in this article.

There must necessarily be a flange around the lower part of the pressure pad as shown in partial view at *D* to serve as a limiting stop to the upward travel of the pad. As it would be rather inconvenient to machine it, more especially if the shape of the blank is intricate as in this case, it is good practice to make the stop flange a separate piece, holding it in place by suitable screws and dowels as may be seen in the sectional view. This construction also permits the diemaker to shear the nearly completed pressure pad into the finished die from the top, thus saving much valuable time and effort in fitting.

In designing the punch, which of necessity must have a good solid flange for rigidity, this flange can be left

off entirely in places that are difficult to machine, as in the case of the rack teeth section of the punch shown at *E*.

Arrangement of the sections in the die is another important feature to be carefully analyzed by the designer. It will be noticed from the perspective view of the die that the sections comprising the rack teeth are so arranged that they can be easily reached by the cutter. As an example let us consider the section *F*:

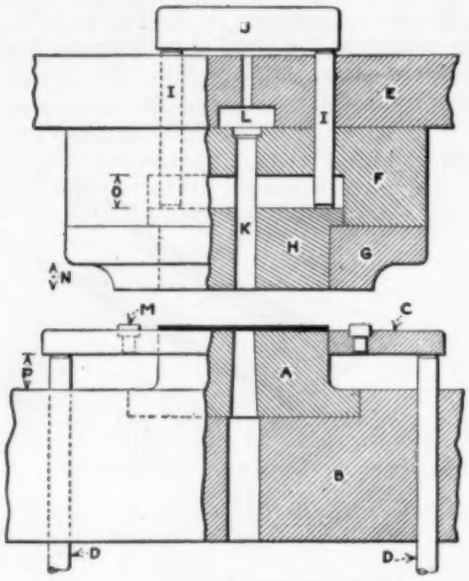


FIG. 5. THE COMPOUND SHAVING DIE

If this section had been extended to *G*, instead of stopping at *H*, it would have been almost impossible to use the small diameter standard gear cutter for the machining of the rack teeth because of interference of the projecting corner *I* with the milling machine arbor, necessitating the making of a special cutter for this operation. All straight sections should be made long, as shown on the sketch, because in this way they are easily made and, if distorted in hardening, can be quickly corrected on the surface grinding machine.

The operation of the spring pad shaving die is quite simple. The punch, being an exact counterpart of the pressure pad and die opening, forces the blank, which is located by the pressure pad, into the shaving die against the spring pressure which is transmitted from below the die through the pins *J* upon which the pressure pad rests. In so doing the surplus stock is shaved off, leaving the blank accurately to size and smooth in finish. The pressure pad pushes the blank out of the die as the punch ascends.

Probably the most efficient of all shaving dies is the compound die. It is possible with this type of die to pierce or shave holes simultaneously with shaving the contour of the blank. The order of placing the punch and die is reversed in the compound die, the punch being held to the lower member, or die-shoe, while the die is fastened securely to the punch holder.

The sketch, Fig. 5, shows a partial section of a typical compound shaving and piercing die. The hardened tool steel shaving punch *A*, which is screwed and doweled to the cast-iron die-shoe *B*, is a snug sliding fit in the machine steel stripper plate *C*. The latter is supported from below on drill rod pressure pins *D*. The upper member consists of a cast-iron punch holder *E*, machine steel sub-die plate *F*, hardened tool steel die *G* and shedder *H;* which latter is a sliding fit in the die opening. The shedder pins *I* are actuated by an ejecter plate *J*, which gets its movement from the knockout rod of the punch press ram from above.

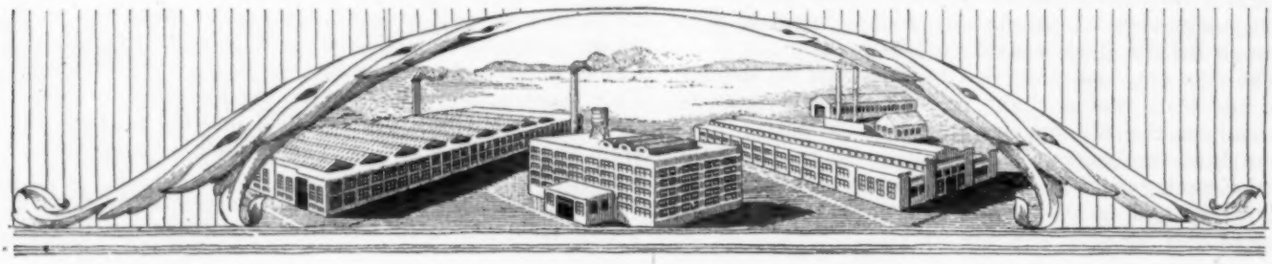
The piercing punch *K* is driven into the subplate *F*, being backed by the hardened steel thrust button *L* in the punch holder, and kept from pulling out by the countersunk head. This construction of a piercing punch, however, is modified for larger sizes and also where the punches are extremely slender. The space available in most cases determines the kind of construction to use. In many large shops where the compound shaving and piercing die is an established institution, a certain standard construction of piercing punch is adhered to and the new designer is instructed in these standards.

In operation, the blank to be shaved is placed on the shaving die *A*; being located correctly by suitable means from the stripper *C*. As the upper member descends, the die *G* comes into cantact with leveling studs *M*, the latter being driven into the stripper plate and ground level with the stock. At this moment the shaving and piercing of the blank begins, the stripper *C* going down with the movement of the die. The slug from the piercing punch is pushed down through the opening in the shaving punch and ultimately drops through the clearance hole in the die-shoe and bolster plate.

After the completion of the shaving operation the blank is carried up with the die *G* until the ejector plate *J* comes in contact with the upper knockout rod, causing the shedder *H*, operated by shedder pins *I*, to eject the finish blank from the die. The sub-die plate *F* is made of machine steel and it serves several purposes. It provides means for holding the piercing and shaving punches and also furnishes space for the travel of the shedder.

In designing compound shaving dies in this manner the thickness of the die proper can be kept to minimum, allowance being made for sufficient stiffness after the shoulder *N* has been ground away in successive grindings of the die. Spaces *O* and *P* should be made equal to *N* plus the thickness of stock to be shaved. Shouldered screws, not shown in the sketch, must be provided for limiting the movement of the stripper.

(To be continued.)



Navigation and Business

Qualifications of Business Managers Should Be as Carefully Scrutinized as Those of Navigators—Functions of Trade Associations

By ERNEST F. DuBRUL
General Manager, National Machine Tool Builders' Association

FROM the earliest dawn of human activity there has been some sort of commerce. Men bartered their products even in the savage and nomadic states of existence. As cities were built some sort of industry flourished. Unfortunately, the history of commerce is almost a sealed book. Historians have probably been of the frame of mind that viewed commerce as something sordid and degrading, so we find history as being more political than anything else.

Babylon, Persia, Chaldea, Egypt, Palestine, Greece, and Rome all had cities of size, and the very existence of cities necessitated commerce to supply their daily wants.

Some of the most important political changes in Rome are known to have been due to pressure of business or economic conditions on certain elements of the population. But as to the every day methods of doing business in Rome we know very little.

We do know, however, that navigation has played an important part in all commerce. Phoenicia, Carthage, Greece and Rome all sent out their ships to bring in products of distant lands, and of course these ships carried the products of the owner countries. At first navigation was simply wild adventure. No maps, no charts, no surveys were available to the first explorers. These developed with the centuries. When the Vikings sailed out to find adventure, without chart or map, a lot of them never came back.

In all ages navigation was backed by business, and as time went on business found it necessary to provide its navigators with charts and maps. At first these were very crude, but in time they were corrected and amplified until now the highly organized coast surveys are even charting the bottom of the ocean. Every rock that is found by a navigator is now spotted on the maps, for the benefit of others, and so navigation is made safer and safer from year to year. Weather observation is a development of very recent times, and storm warnings are given out, so that navigators can lay their plans with greater safety.

No matter how good his maps and charts, a captain has to know how to take his observations, to lay his course from day to day. And he has to know how to run his ship according to many changeable and changing conditions.

Because of the value of human life and the value of property entrusted to a ship captain's care, no one is allowed to take out a ship without passing an examination as to his qualifications, nor without showing by a long apprenticeship that he is actually qualified by experience as well, to be entrusted with the management of a ship. If he passes the examination he gets his license and only then can he take out a ship. Likewise, all the ship's officers and engineers have to have licenses.

Now business finds all this to be good for a mere branch of business—navigation. It recognizes the science as well as the art of navigation. Why should business be so slow in recognizing the science and art of business itself? Why should business men allow all kinds of people to put out a lot of water-logged business concerns to clutter up the channels of business itself? Why should not business men freely report experience and information that will assist in the making of business charts and maps that will plainly show the dangerous rocks on which are wrecked 87 per cent of the businesses launched from day to day?

But business men seemed to prefer the wild adventuring. They didn't want to show exactly the courses they sailed or the dangers they met, because each seemed to think that he had a little island off in the business ocean that he could exploit all by himself, and he didn't want anybody else to know anything about it. He didn't realize for a long time that a lot of other fellows knew as much as he did about ways of getting to that island and when he himself got to it he often found others on the ground—perhaps more than the business of the island really justified.

Some businesses have begun to realize that charts and maps of business will help them, as well as everybody else, and they are now, through various agencies, governmental, individual and associate, contributing business information of general value. They are plotting their past voyages and taking business weather conditions into account in planning their future trips. Some of them are studying the fundamental sciences underlying their businesses and are giving attention to the main science that will better their course—economics.

Some of them recognize the danger to business navigation caused by business craft being operated by incompetent navigators, and through trade associations they better their own methods and help educate their fellow navigators.

Business is learning the generous laws of the sea. It is not so long ago that piracy on the high seas was prevalent, but it dawned on society that piracy was bad for humanity and bad for business, and so piracy was eliminated. In the same way business piracy is being eliminated through various legislative enactments—such as the Sherman Law, the Clayton Act—that keep open the doors of equality of opportunity.

Business is learning the humane and generous lesson of rescue and salvage of business craft in distress. Creditors' committees nowadays find it much better, as well as humane, to keep a business going if possible, rather than to push it onto the rocks of bankruptcy.

If, now, business will demand that, like ship's officers, business officers should be chosen only from among those who know the rules of the road, and the science of business navigation, and from those who have attained their qualifications by study and experience, business will take a long step forward.

The blue-sky laws passed to protect the investor from fraudulent promotions, do not protect the investor from ignorance and incompetence in business management. Not all states have even a blue-sky law. None has a "Corporation Manager's License Law."

A start has been made by licensing public accountants, but this only touches the fringe of business. A license would not be needed for managers of small business, any more than for an oarsman who only rows himself out in his own skiff. But when a business venture is incorporated, and thereby uses the rights and privileges conferred by the state, it is not too much for the state to ask that the corporation provide itself with duly qualified and certified managers who will know how to keep the corporation on a safe business course, and will know how to keep it safe for all those who are embarked in it as well as for all others who may be navigating the seven seas of business.

A Cylinder Milling Fixture

A Double Cylinder Fixture Which Allows Adjustment in Every Direction—Gages for Securing Equal Compression Space

SPECIAL CORRESPONDENCE

THE double milling fixture for handling cylinder blocks of the Peerless eight-cylinder motor has a number of interesting features. The general appearance of the fixture is shown in Fig. 1. The cylinder is placed in the fixture resting on the two inclined surfaces *C* and *D*. The clamps *A* and *B* slip into holes left by the water-jacket cores. The ratchet wrench *G* operates the screw shown at *E*, Fig. 2, which holds the end clamping jaw against the cylinder.

Depth gages *F* are placed in both the end cylinder bores. The swinging gage *H* is then moved to both of the depth gages, determining the depth of the cylinder in order to get the distance from the combustion chamber to the bottom flange.

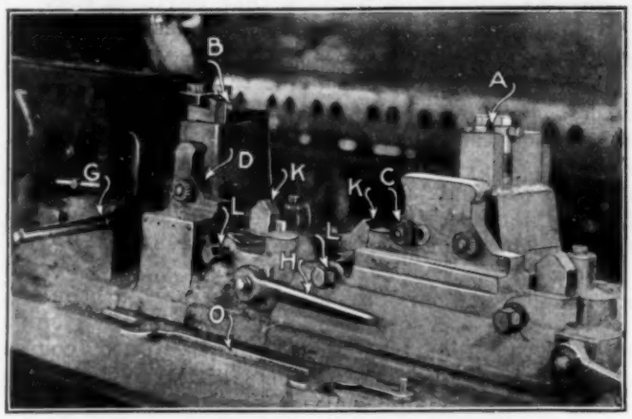


FIG. 1. PEERLESS CYLINDER MILLING FIXTURE

Positioning the Cylinder

The cylinder is positioned by means of the two clamps *K* and the two screws *L*, which force the cylinder away from the swinging gage *H*. The screws *M* are operated by means of a key-wrench as shown at *N*, and move the cylinder toward the operator if necessary, in order to bring the points *F* into proper relation with the swinging gage *H*, and so determine the proper depth of the combustion chamber in relation to the bottom flange.

On the opposite side of the cylinder the target profile gage *O* is used. This gage carries a profile of the two end cylinders and the beading flange. One end of the cylinder block is adjusted by means of two plungers *J* which in turn are actuated by the two screws *I* to lower or raise the cylinder with relation to the profile gage *O*. The screw *E* is clamped tight with the ratchet wrench when the clamps *A* and *B* are fastened. The swinging gage *H* is then lowered and the depth gages *F* are removed as well as the target profile gage. The cylinder is then ready for milling.

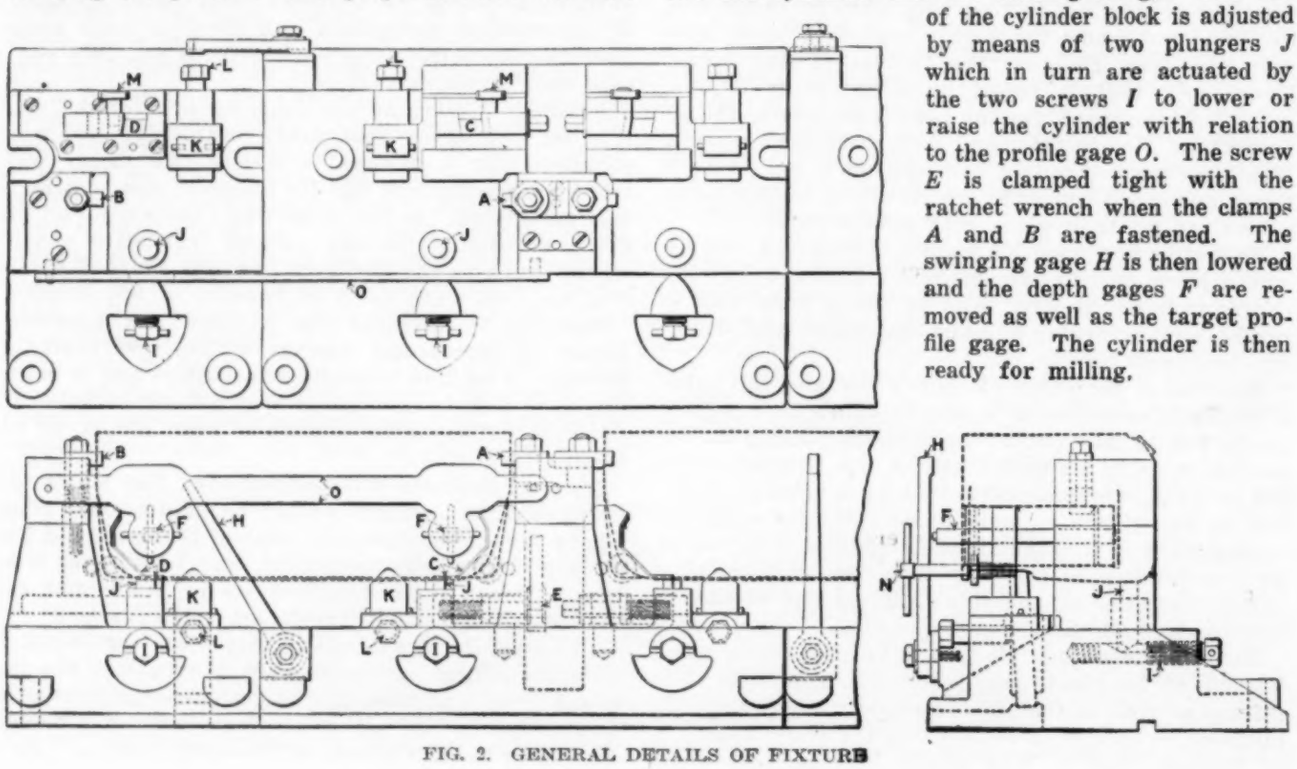
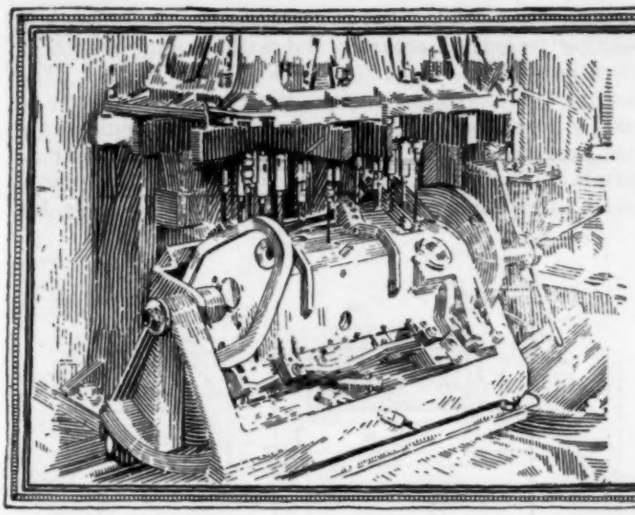


FIG. 2. GENERAL DETAILS OF FIXTURE



Tool Engineering

By

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Chucking Long Work—The Use of Locating Rings—Special Face-Plate Fixtures—Ring Pot Fixtures—Fixtures for Rectangular Work—Holding Thin Castings

IN A PREVIOUS illustration several methods were shown for holding long, cylindrical work, but these were comparatively small pieces. The casting shown at *A* in Fig. 231 is of good size and quite long so that it needs additional support at the outer end. It would be possible to design a set of chuck jaws to hold it without any additional means of support, using one of the principles shown in the previous illustration. A simpler method and one which is less expensive is given, however, as it is more suited to the particular piece we have illustrated. The method of centering the work is by means of jaws *B* which not only provide an end location but at the same time center it accurately. In order to give support to the outer portion of the casting a ring pot *C* is fastened to the face of the chuck. This pot is cut out in three places at *D* in order to allow the chuck jaws to operate. Considerable allowance should be made around the jaws in order to prevent trouble which might be caused by chips and dirt. By coring the holes in the casting no machining is necessary except the facing of the bottom of the pot and the drilling and tapping for the set-screws at *E*. These screws are used to support the work and are set up by hand. When each piece is placed in the jaws care must be taken not to exert too much pressure as otherwise the casting might be distorted. It would be possible to use spring jacks in place of set-screws and there would be some advantages in this method as there is less likelihood of distortion. This is a cheap arrangement, involving very little trouble and giving satisfactory results.

Chucking With a Locating Ring

The example shown in Fig. 232 is a little out of the ordinary as it involves the use of a chucking ring *B* which is placed on the casting *A* and which helps to support and center the long hub. Several chucking rings should be provided as they are put on the casting before it is placed in the chuck. A setscrew *C* holds it firmly in place so that the end does not "wobble." The outside of the ring is made in spherical form so that it fits the hole in the chuck at *D*. The jaws used in this case are arranged so that they grip the work at the point *E* and the end location is obtained through the hardened stud *F*. A method of this kind can be used to advantage when the work is long and it is not desirable to have it extend too far out from the face of the chuck. The portion *G* of the casting is slightly tapered so that the ring fits it snugly and it is often unnecessary to tighten the setscrew. Theoretically the jaw at *E* should be almost a knife edge but in actual practice it can be made about as shown without experiencing any difficulty.

The pot casting shown at *A* in Fig. 233 is to be

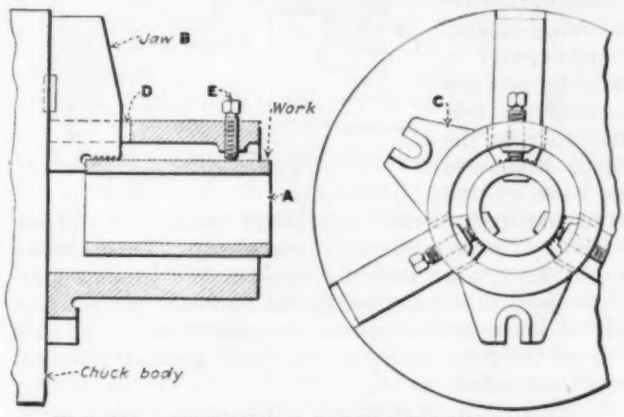


FIG. 231. CHUCKING A PIECE OF LONG WORK

machined at *B* and *C* in such a way that the outer wall is concentric with the inside. It is therefore necessary to devise a means of holding which will locate the work from the inside cored surface. The chuck is equipped with entirely special jaws, one of which *D* bears at *E* and *F* on the inside of the casting. A reference to the end view will show that jaw *D* is quite wide and that it is relieved in the center so that it bears at two points *K* on the inside surface of the casting. The other jaw *L* has a swivel member *M* which equalizes any variations which there may be in the inner cored surface, thus permitting the chuck to grip the work firmly and with a uniform pressure. The rod *N* is set into the body of the chuck so that it will act as an end stop for the casting. When jaws of this kind are to be made it is quite necessary to make them very substantial on account of the amount of overhang from the chuck. Unless they can be made very stable it is not advisable to use them but rather to devise some other method of holding, in order to obtain the desired results.

In Fig. 234 is shown a piece of work *A* which cannot readily be held in chuck jaws. It appeared advisable therefore to make up a special faceplate for the purpose. The faceplate *B* is fastened to an adapter *C* which screws on to the end of the spindle. In the center of the faceplate is a spring bushing *D* which has a tapered end *E*. This end acts as a locater in the casting and centers it on the faceplate. The flange *F* rests on three hardened points *D* equally spaced in the body of the fixture. These points are so arranged that they can easily be replaced when worn or broken. In setting up the work a plug can be placed in the turret of the machine and carried forward so as to hold the work in place while the clamps are being tightened. These clamps are three in number as shown at *G* and they are slotted so that they can easily be removed from the work. They are set up by means of nuts at *H*. Attention is called to the method in which the outside of the faceplate is carried up in the form of a ring in order to form a continuous surface so that the operator will not be endangered by projecting clamps. If desired, it would be possible to carry the bolt which operates the clamps through to the back of the fixture and tighten them from the side instead of from in front. The convenience of the operator must always be considered when deciding on a point of this kind but in the particular case mentioned it would probably be fully as convenient to operate the clamps from the back as from the front and the cost would be little different from the method shown.

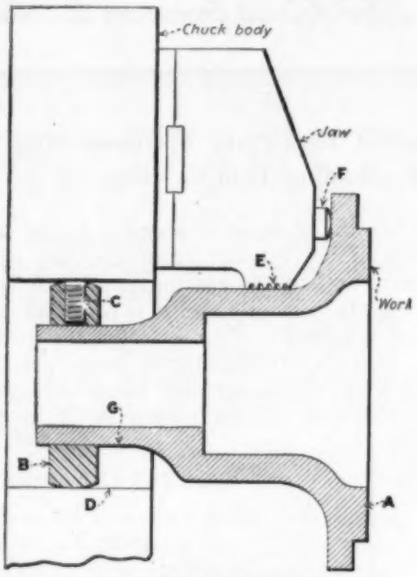


FIG. 232. CHUCKING WITH A LOCATING RING

Chucking a Long Sleeve

When work is very long and extends a great distance out from the spindle, it is sometimes necessary to provide an additional support other than that which can be obtained from the chuck or faceplate itself. It is always objectionable to make any fixture with too great an overhang from the spindle as this is likely to cause vibration and imperfect work.

Fig. 235 shows an example of this kind in the work *A* which is a long cast-iron sleeve held and centered at one end by the chuck jaws *B*. A casting *C* is bolted to the face of the chuck as shown and the outer end of this casting is fitted to a cylindrical sleeve *D* and bolted thereto. At the outer end of this sleeve are three setscrews *E* which are used to center the work and hold it in position. A special steadyrest *F* is mounted on the ways of the turret lathe in such a way that it supports the sleeve *D* which is a running fit in the large bearing at *G*.

An arrangement of this kind permits a piece of long work to be held firmly even though it extends a long distance out from the end of the spindle. It is therefore possible to hold it securely and without any chance of vibration while the cutting tools are in action. The casting *C* is cored out so that the three jaws *B* can be readily moved without interference. Cored openings are also provided in the walls as shown at *K*, in order to permit chips and dirt to fall out. In making up a steadyrest of this kind provision should always be made for

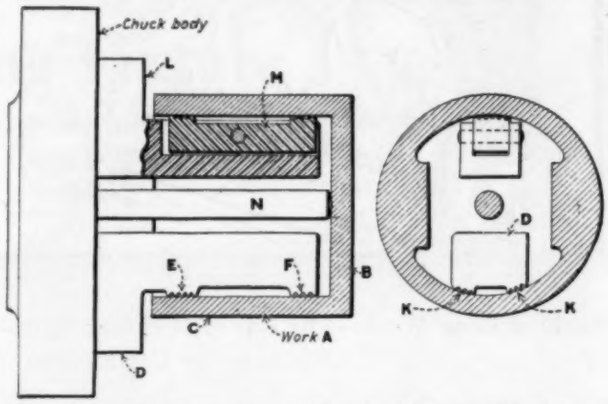


FIG. 233. TWO-JAW CHUCK WITH EQUALIZING JAW

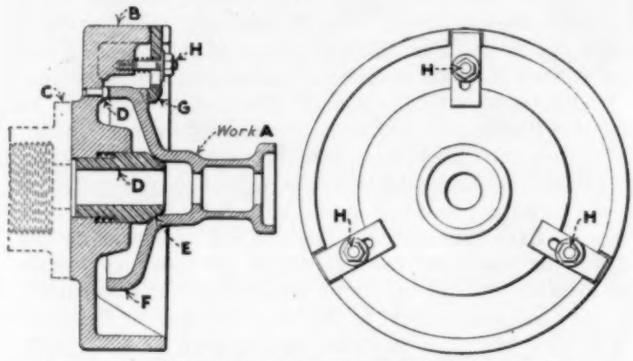


FIG. 234. SPECIAL FACEPLATE FIXTURE WITH LOCATING PLUNGER

oiling the bearing, either by means of a large glass oil cup or some other approved method.

The problem of holding thin work requires care and thought in its solution. The matter of distortion is of great importance and unless a proper method of holding is determined upon, the work will be untrue when finished. In addition to the possibility of distortion there is always a likelihood of extreme vibration on account of the thin and unsupported walls of the casting. Therefore the cutting tools that are used must be correctly designed in order to counteract this tendency as far as possible. More will be said about this matter under the head of "cutting tools." Fig. 236 shows several methods of holding a thin ring pot *A*. This casting is of a type commonly used in making piston rings. Both the inside and outside of the casting are finished and it is then cut up into narrow rings of a predetermined width.

If the work here considered is held in jaws like those shown at *B*, the casting will undoubtedly be distorted from its original shape as shown at *C*, because it would not be possible to hold the work firmly without exerting considerable pressure on the jaws. It is possible to avoid this difficulty by making up a set of special jaws like those shown at *D*. The outside of this jaw can be set up lightly on the ring part with just sufficient force to prevent it from turning freely by

hand, and after this is done the hook bolt *E* can be tightened so as to make a firm metal-to-metal contact. There is an added advantage to this method of holding, in that it tends to "kill" the vibration in the metal and thus prevent "chatter." A device of this kind can be used for many kinds of thin work whether it is regular or irregular.

The method shown at *F* is most commonly used for

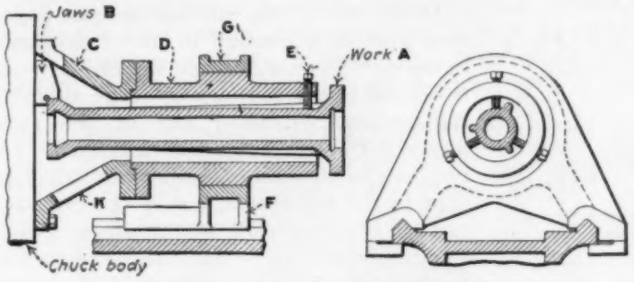


FIG. 235. CHUCKING A LONG SLEEVE

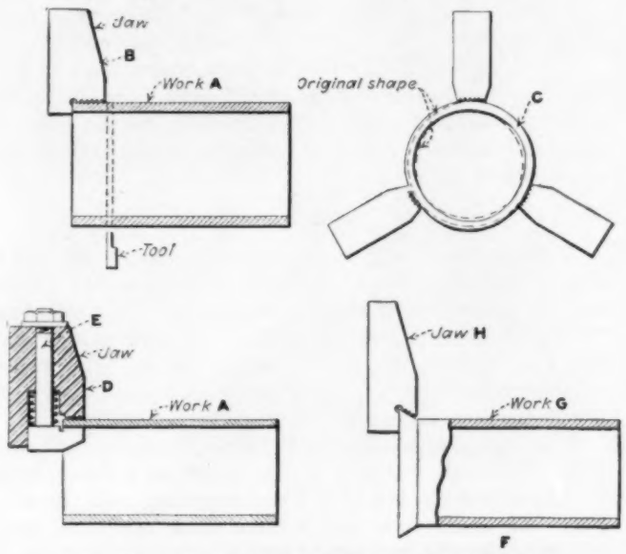


FIG. 236. SEVERAL METHODS OF HOLDING A THIN RING POT

the manufacture of piston rings. A special form of pot casting is made up like that shown at *G*. One end is provided with an angular ring of sufficient thickness to withstand the crushing action of the chuck jaws *H*. The angularity of the ring keeps it from pulling out of the jaw and at the same time tends to hold it back strongly against the seat of the jaw. Naturally there is considerable waste when this type of casting is used, but this is offset by the convenience of operation and the good results obtained.

Two-Jaw Chuck Used for Rectangular Work

The work *A* shown in Fig. 237 is a casting of such shape that it may be held in a fixture or by means of chuck jaws. The work which is to be done is shown by the marks *f*. There is very little danger in using this method of holding if the casting is small; but if of large size it would probably be necessary to provide extra supports under the corners *B* and *C*. These might be made in the form of spring jacks and attached to the face of the chuck if desired. The jaws *D* in the case shown are cut out in V-form so that they receive the corners of the casting and at the same time center it so that the hub *E* is in proper alignment with the center of the spindle. The method of chucking shown here holds the work very firmly but it is open to the objection mentioned when the work is large.

Holding Fixture for an Aluminum Casting

In Fig. 238 is shown an aluminum casting *A* of somewhat similar form to that previously described, but the method of holding is decidedly different as the piece is considerably larger in size. Furthermore it must be made accurately to size and the surface *B* and the relieved proportion *C* must be machined very carefully. The fixture body *D* is bored out and threaded at *E* to fit the end of the spindle but it can also be made in such a way that it can be attached to an adapter if this seems advisable. The work is located on three fixed points, *F*, *G* and *H* in the body of the fixture. A fourth point *K* is adjustable and can be made in the form of a spring plunger which is locked by the hollow setscrew and plug at *L*. There are three round knife edges at *M*, *N* and *O* against which the work is located by means of three swinging knife-edged clamps, *P*, *Q* and *R*, thus locating the work and at the same time preventing it from pulling out of the fixture. Two supporting jacks at *S* and *T* take the thrust of the cut when facing the boss *U*. These spring jacks are respectively located by the setscrews and plugs at *V* and *W*. This design of fixture will be found useful for work on which clamps cannot be applied in the usual manner. The design is clean and simple and there is no tendency to distort the work unless too much pressure is applied to the clamps *P*, *Q* and *R*. The action of these swinging members has been previously described in the articles on "Drill Jig Design."

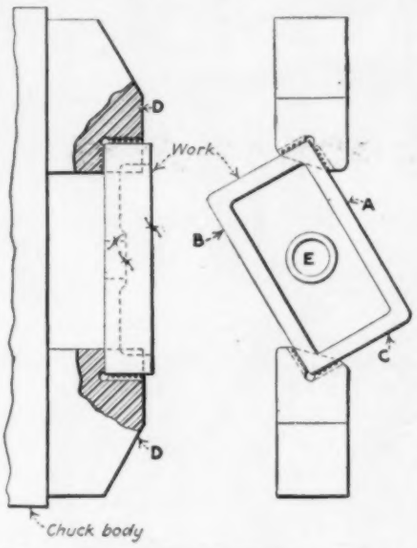


FIG. 237. TWO-JAW CHUCK HOLDING RECTANGULAR WORK

Holding Fixture for Fragile Aluminum Casting

In Fig. 239 is shown at *A* an extremely difficult piece of work to hold and machine without considerable distortion. The fixture shown in the illustration gave excellent results in use although it appears somewhat complicated in design. The casting *A* is of thin aluminum and the portion *B* is approximately $\frac{3}{4}$ in. thick and entirely unsupported. The portion *C* is only $\frac{1}{8}$ in. thick and is machined all over the face shown. The entire face of the flange *D* is machined and the tongues *E* are also cut to an accurate diameter in the same operation. It will be understood from the foregoing that it is necessary to hold this work in such a way that it will not be distorted either by the clamping or during the process of machining. The work is set up and located in the "V" *F* on the body of the fixture and it rests on three fixed points *G*, and a spring plunger *H*. The portion *E* is supported by three spring plungers *K*. A single knife edged point *L* acts as a

stop against one side of the work. It is clamped in this position by means of the swinging knife edge *M* and it is thrown over in the V-block *F* by another knife edge clamp *N*. The flange *B* rests between the jaws of

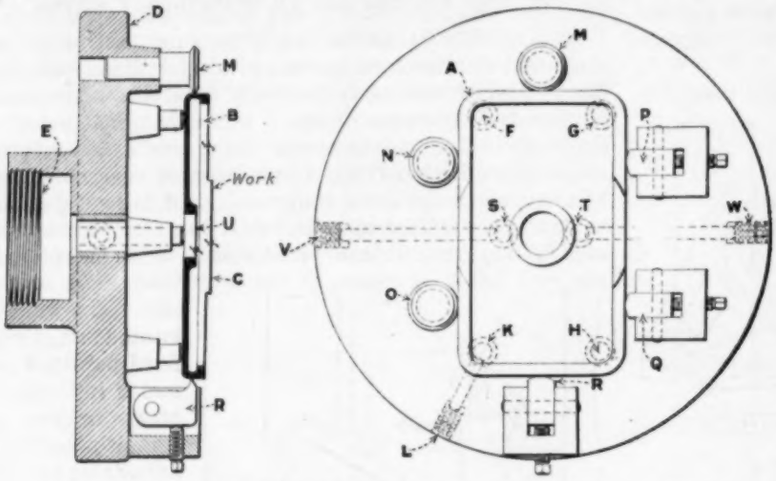


FIG. 238. HOLDING FIXTURE FOR AN ALUMINUM CASTING

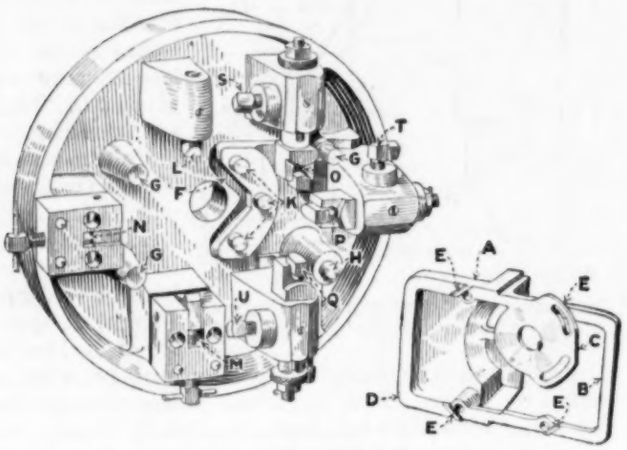


FIG. 239. HOLDING FIXTURE FOR A FRAGILE ALUMINUM CASTING

the floating hook bolts at *O*, *P* and *Q*. The floating clamps are so arranged that they can be tightened so that they hold the work firmly and yet do not distort it. After they have been tightened the setscrews at *S*, *T* and *U* hold each hook bolt in position.

Reminiscences of an Old-School Machinist

By R. Thomas Huntington

During the eight months that I worked for the Baldwin Co., I had no occasion to ask the foreman for work. Every morning as the whistle blew, the foreman would go to each man (whose work was just behind him on the floor; the finished work in one pile, unfinished in another pile) and if there was not enough of the latter to last through for ten or more hours, would make a note of same whereupon the truckers would bring in more work; one piece for each finished piece taken.

Each machine had its particular work to do, and it was very seldom that any change was made. The foreman visited each workman at least once a day—he had between one hundred and two hundred workmen—and looked over his work. If any defects were found that the man could remedy, the foreman placed the defective piece with the unfinished work. If a defective casting or forging was found, a big chalk mark would be placed at the defective place and such pieces were also placed with the unfinished work. If any of the work was spoiled, a different mark would be made on it and the piece placed between the finished and unfinished work. If there were too many spoiled or defective pieces, the man was quite likely to lose his job.

There was a like number or quantity of each part in the rough in the stockroom or in the works being finished and orders would be issued to the foundry or forge shops for replacement whenever any of the rough pieces were sent out to be machined. I do not believe the boilers, tenders, or cabs were kept in the stockroom, but as the completed engines were run off of the erecting floor, other boilers were ready to take their places. Certain men were assigned to do certain operations and as fast as they had completed their task on one boiler or engine, they passed on to another that was waiting for them. This is the first instance of team work in the machine shop that I ever came in contact with. In case of rush orders there might be from six to twelve locomotives on the floor at once, with a relay of workmen to each.

Good Advice

There was one man at the Baldwin shops who gave me some very good advice. I went to him one day as boys are apt to do, telling about a shopmate. This man said: "Now, Thomas, if you can tell me something nice about him I will listen, but if you cannot, I do not wish to hear what you have to say. You should not repeat anything about any one unless it is a good deed or action."

This man also tried to interest me in mechanical drawing. Although working at the bench as a fitter, where he assembled the boxes in the connecting rods, he was a very fine draftsman, and I have since regretted that I did not take the lessons.

Motor Transport in Rumania

There are several companies operating motor transportation and freight lines in Rumania, but owing to the cost of repairs, the wear and tear of tires due to the state of the roads and probably careless handling in some cases, there is little profit in this business under the system hitherto adopted, states the commercial secretary of the English Legation at Bucharest in his recent report on economic conditions in Rumania. Quite recently an interest has been expressed in 2- and 2½-ton trucks for road transport, worked in conjunction with a 2-ton trailer. Thus the load would be 4 tons for each machine and trailer. This distribution of the load over four axles will probably prove more practicable than the use of heavier trucks. Many of the main roads in old Rumania are practicaly unmade, so that the weather constitutes a serious factor with which this business has to contend. At the same time high-priced goods can be transported economically from and to the large centers of population by this means, and there still remains a good field for those firms that are able to buy trucks and import them to Rumania for the purpose of entering the motor transport business.

Interesting Inspection Methods

Fixtures and Gages for Inspecting Crankshafts—Camshafts Measured by Micrometer and Tested for Hardness by Scleroscope—Inspecting and Weighing Connecting Rods

BY FRED H. COLVIN
Editor, *American Machinist*

THE last operation on the Essex crankshaft before the final testing and inspection is that of polishing the bearings, utilizing the clamp method as shown in Fig. 1. A fine grade of abrasive cloth is held between the two clamps and the surfaces of the bearings brought to the desired degree of polish.

The crankshaft is then placed in substantial V-blocks mounted on one of the testing benches, as in Fig. 2.

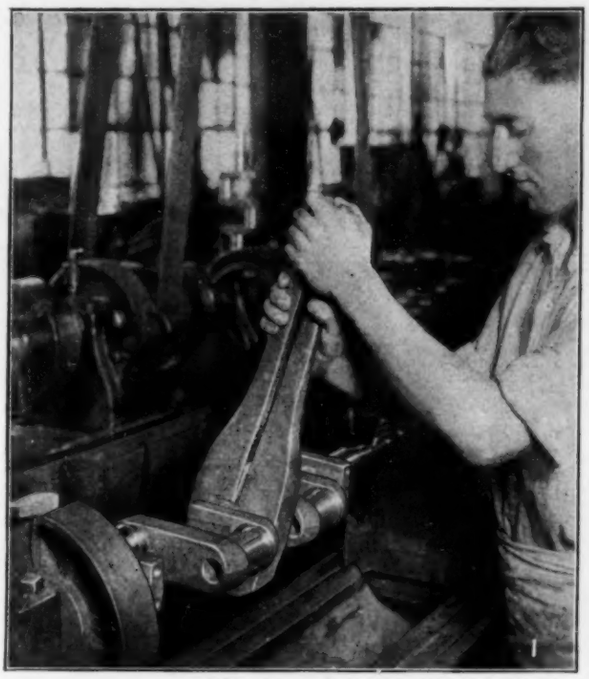


FIG. 1. POLISHING THE MAIN BEARINGS

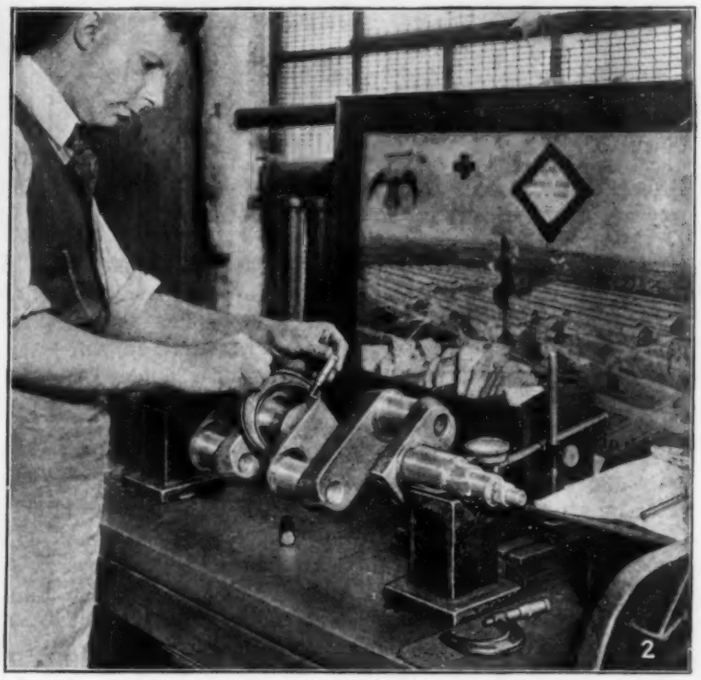


FIG. 2. TESTING THE MAIN BEARINGS

FIG. 3. INSPECTING THE CRANKPINS

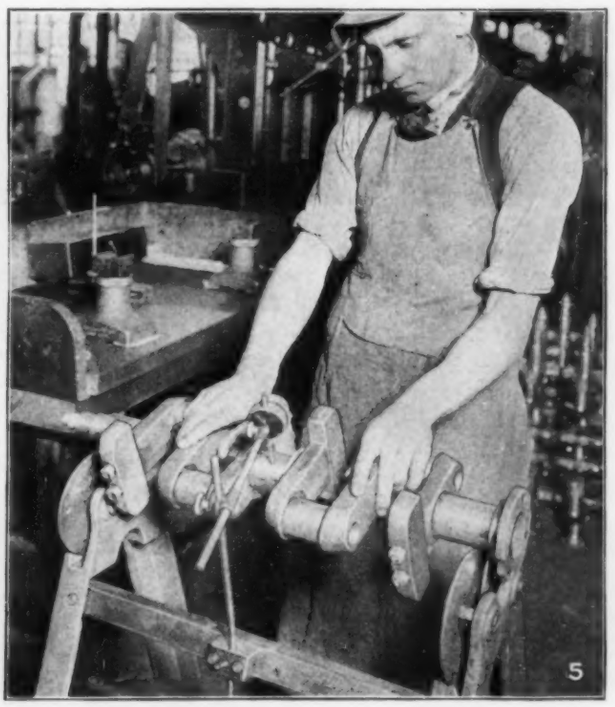


FIG. 5. TESTING FOR STATIONARY BALANCE

FIG. 4. INSPECTING MAIN BEARINGS

FIG. 6. MEASURING THE CAMS

Here it is supported by the end bearings which rest on suitable pads in the V's to prevent marring or damaging them in the slightest degree. The bearings are tested for diameter, with the micrometers shown.

In testing the crankpin bearings, the crankshaft is mounted in the fixture shown in Fig. 3 which contains three sets of large rollers to support the main bearings while the crankpins are being tested. The crankpins are all tested in this way. This method allows the crankshaft to be turned in various positions so that all the crankpin bearings can be inspected. The stand which supports the dial gage can be moved to inspect all four pins, the blocks *A* and *B* being two of those provided for this purpose. The block *C* carries what may be called an indexing pin for locating the crankshaft in the desired position. Two other gages are shown at *D* and *E*.

In Fig. 4 the counterweights have been added to the crankshaft which is again mounted on the block and the center bearings tested with the dial gage to be sure that the shaft is not sprung but that the three main bearings are in line.

In the final test the crankshaft, with the counterweights attached, is mounted on the roller balancing ways shown in Fig. 5 and tested for static balance, the center bearing being again tested with the crankshaft free to revolve on the disks shown.

Coming to the camshaft, Fig. 6 shows that the micrometer is depended upon to be sure of the correct size. It also shows how the camshaft is supported during grinding by its large diameter bearings which ride in a suitable support as at *A*, to guard against springing by the wheel pressure.

Before the camshaft goes to the assembling department all the wearing surfaces are carefully tested for hardness by the scleroscope as indicated in Fig. 7. It

FIG. 8. MEASURING THE CENTER BEARINGS

FIG. 9. TESTING SQUARENESS OF CONNECTING RODS

is then finally tested in the stand shown in Fig. 8, the end bearing being suitably supported and the diameter and concentricity both tested by the use of micrometers and the dial gages shown.

Insuring Accurate Connecting Rods

An interesting and ingenious method of testing the squareness of both ends of the connecting rod is shown in Fig. 9. Here the large end of the rod slips over

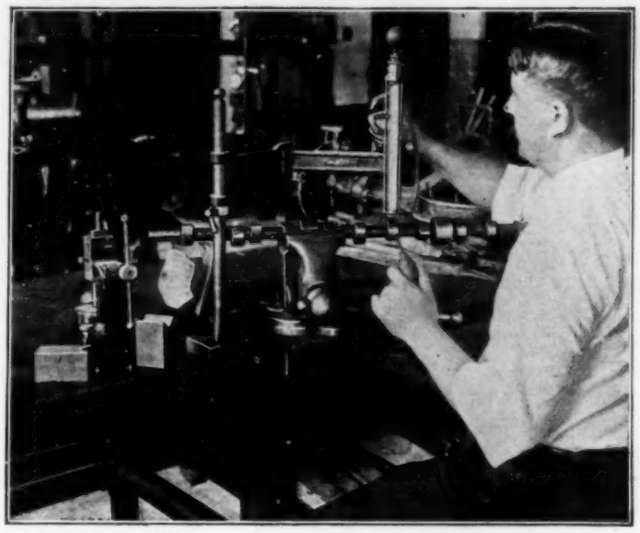


FIG. 7. TESTING THE HARDNESS OF CAMSHAFTS

FIG. 10. WEIGHING THE CONNECTING RODS

the stud *A*, which is a good twist fit. The disk *B* has a central stud which fits the hole in the small end of the rod and a connecting rod is then swung on *A* so that the disk *B* moves across the face of the corresponding disk *C* which is set square with the stud *A*. The large diameter of these disks multiplies the error very rapidly, the feeler which is shown in Fig. 9 being used to measure the amount by which the holes are out of square. Similar methods are used in a few other shops, but these are the largest disks yet noted and they make a very severe test for the accuracy of the end holes with each other.

The rods are finally weighed as shown in Fig. 10, the weight being held within close limits and the rods placed in separate bins, according to the weight, so that rods as nearly alike as possible will be assembled in the same motor.

Rathenau Statements Indicate That Reports on German Competition are Exaggerated

During the period which has elapsed since the establishing of the reparations question between the Allied Nations and Germany, there has appeared in print and also obtained circulation through various other sources, much in the way of reports as to Germany's competition with the rest of the nations and her ability to ship her manufactured products to the ports of the World at prices beyond any hope of competition.

Students of the situation in this country, including the chiefs of the various bureaus connected with our Department of Commerce, have from time to time expressed skepticism as to the truth of these statements as applied particularly to manufactured goods, when material, quality and workmanship were taken into consideration.

If we are to judge by the printed word of Germany's chief spokesman on such matters, Walter Rathenau, Minister of Reconstruction, we have been more scared than hurt, for in his latest book called "The New Society," published in German, and only recently translated into English, he makes the following remarkable statement, found in Chapter VI, and which is worthy of the earnest attention of those who have been anticipating disastrous competition from Germany.

After approaching the subject from its various social and industrial angles, he says:

"The absolute productivity of work, the relative efficacy and the quality of the product, have all deteriorated. With smaller turnover we have witnessed a falling off in the excellence of the goods, in research-work, and in finish. Industrial plants have been worked to death and have not yet recovered. Auxiliary industries, accessories and raw materials have fallen back. High-quality workmanship has suffered from defective schooling, youthful indiscipline and the loss of manual dexterity. The new social order has lost a generation of leaders in technique, scholarship and economics. Universities with all institutions of research and education, have suffered from this blank. Technical leadership is gone, and the deterioration in quality has reacted detrimentally on output. We can now turn out nothing except what is cheap and easy, and what can be produced without traditional skill of hand, without serious calculation and research. For all innovations, all work of superior quality, Germany is dependent on the foreigner. The atmosphere of technique has vanished, and the stamp of cheap hireling labor is on the whole output of the country."

On page 59 of the same chapter, in speaking of things of common use, Mr. Rathenau says:

"Our half, or wholly imitative products are turned out as cheaply as possible in substitute materials and are made as well, or as ill, as the relics of our craftsmanship permit, or as our existing machinery for that purpose is capable of. Cheapness and ease of manufacture are the principles aimed at."

Structural Properties of Metals and Alloys

By R. W. WOODWARD
Physicist, Metallurgy Division, National Bureau of Standards, Washington, D. C.

(Continued from last week's issue.)

WHEN a metal is heated it will with few exceptions increase its linear dimensions and the amount of this expansion per degree for a unit length is known as the coefficient of linear expansion. This coefficient is not quite the same at high temperatures as for low temperatures but for ordinary purposes it may be considered a constant.

In all structures where large changes in temperature are encountered, allowance must be made for the expansion of the metal. This is particularly the case if two different metals are in proximity, as the various metals and alloys in general have different coefficients of expansion. For example, in gas engines having aluminum alloy pistons a greater clearance must be provided than in a similar engine equipped with ordinary cast-iron pistons. Similarly, the comparison of gages with precision blocks requires that careful control be kept of the temperature so that the corrections due to expansion may be accurately known.

The expansion of an alloy cannot in general be predicted from the expansion of the component metals. A steel termed "invar," containing about 36 per cent nickel, has the lowest coefficient of any known metal or alloy and hence is much used for standards of measurement or for scientific instruments where constancy of dimensions is required. Other alloys of nickel and iron have the same expansion as glass and can be used for the sealing-in wires of incandescent lamps where a gas tight joint is required. Platinum may also be used for the same purpose but is, of course, more expensive.

The patternmaker, in constructing patterns, makes a shrinkage allowance of from $\frac{1}{8}$ to $\frac{1}{6}$ in. per foot according to the metal which is to be cast. This allowance is approximately equal to the expansion of the metal from the solidification temperature down to atmospheric temperatures. Type metal alloys expand instead of contracting during cooling and this aids materially in making a clean cut and sharp casting of the type face.

Pure metals (i.e., single elements) melt upon heating or freeze upon cooling at a definite temperature. Alloys, except for certain mixtures of their constituents, do not have such a single melting point but will melt or solidify over a range of many degrees. Advantage is taken of the latter fact in ordinary plumber's solder used for wiping joints. The solder becomes pasty during the solidifications period and allows the plumber to manipulate and shape the solder into the desired form about the joint.

The melting point or range of an alloy is generally less than that of its component metals and low melting alloys can be made upon this principle. An alloy of 50 per cent bismuth, 25 per cent lead 12.5 per cent tin, and 12.5 per cent cadmium will readily melt in hot water although the lowest melting point of any of the constituents, that of tin, is 450 deg. F.

Ordinarily in machine construction little use is made of the fact that metals conduct heat. In some instances such as refrigeration machinery, heating apparatus, or engine design, a knowledge of the conductivity of heat is required. The order of metals as regards thermal conductivity is practically the same as that for electrical conductivity, and for most metals there is a constant ratio between the two. Silver is the best conductor, copper and gold respectively about 75 and 55 per cent that of silver. In other words, if similar shaped bars of silver, copper and gold are heated to the same temperature at one end, at the expiration of a given time 75 per cent as much heat will have flowed to the other end of the copper bar as has in the silver bar, while in the gold bar the transfer will be only 55 per cent. The other metals are quite inferior in their conducting properties to the three named above. It is also a fundamental fact that any alloy will have a lower conductivity than any of its constituent metals. This will be treated more fully under electrical conductivity.

Many metals and alloys undergo transformations at various temperatures which markedly alter their properties, the material being in a different crystalline state. A familiar illustration is carbon (carbon however is not a metal), which also exists as diamond and graphite. All of these are the same fundamental element, carbon, but their properties are quite different; in this case, however, a change of pressure is also necessary to produce the various modifications.

The heat-treatment of steel and other alloys is fundamentally due to this phenomenon but can only be briefly mentioned at this time. When the steel or other alloy is heated to a point above the transformation temperature and then suddenly cooled as by quenching in water, the crystalline state present at the higher temperatures is retained at the lower temperature. For steel this brings about greater hardness and increased tensile strength but for some alloys less desirable properties would be brought about by a similar treatment. The microscope is extremely valueable in determining the crystalline structure of metals and alloys, interpreting the properties that may be expected from the observed structure and in advising the proper treatment to be given.

There are many other thermal properties that could be discussed such as boiling point, specific heat, latent heat, vapor tension, etc., but their knowledge is not essential to the designer or constructor of machinery except in special cases.

Electrical Properties

The electrical properties of metals and alloys are important for all apparatus in which electricity is employed. When a metal is required to transmit electric current, its ability to do so becomes of first importance. Pure metals are the best conductors of electricity, silver, copper and gold being the most efficient as mentioned above under heat conductivity. Aluminum is next in order and although it is a poor conductor relative to copper, it is used in preference to copper for long transmission lines when the relative cost of the two materials is in favor of aluminum.

A more useful manner in which to express the ability of a metal to conduct electricity is in terms of its resistance or the tendency to oppose the flow of the electricity. The specific resistance or resistivity is the resistance of a unit volume of the material and from

its value the actual resistance of a conductor of any size may be computed. The resistance of most metals increases with a rise in temperature and within certain limits this rise is a constant ratio for each degree of rise. This ratio is the temperature coefficient of resistance.

Alloys always have a greater specific resistance than their constituent metals, although the temperature coefficient is generally less for the alloys than for the pure metals. Thus for electrical heating apparatus, which depends upon the resistance of the metal to develop the heat, alloys are generally used because of their high resistance, although such materials must also be able to withstand the oxidizing effect of the atmosphere when heated to the desired temperature.

Certain alloys such as manganin (a copper, manganese and nickel alloy) and constantan (a copper-nickel alloy), have a temperature coefficient of resistance which is practically zero and such materials are therefore used for constructing standards of resistance or for resistances which must remain of a constant value over a range of temperature.

Use is also made of the temperature coefficient as a means of measuring temperature; by measuring the resistance of a coil of wire at two different temperatures the temperature interval may be computed. For such purposes a metal with a high temperature coefficient would be desirable, and accordingly a pure metal such as platinum or nickel is used.

When two dissimilar metals are jointed together at each free end and the junctions are kept at different temperatures an electric current will flow through the metals. This is the principle of which use is made in the thermo-electric method of measuring temperatures, and which is used almost universally in the heat-treatment of steel. For the same difference in temperature all metals will not generate the same electromotive force or voltage and those metals and alloys are used for measuring temperatures which generate the largest electromotive forces and also have the requisite stability and cheapness. Platinum and platinum alloys are used for exact scientific work, where cost is not a controlling factor, because of the constancy of the metals and the ability to withstand high temperature. The so-called base metal thermo-couples (generally nickel alloys) are used in industrial work mainly because of their low cost; but they also give much larger thermo-electric forces than the platinum couple, and are in general quite constant in their properties if not abused.

Magnetic Properties

The magnetic properties are usually associated with iron, steel or other alloys containing a large percentage of iron. While these metals are by far the most strongly magnetic, two others, namely, nickel and cobalt, also exhibit magnetic properties. There are also alloys of copper, manganese and aluminum known as Heusler alloys, which are unusual in possessing similer characteristics although none of their constituent metals are magnetic.

Magnetism in a magnetic material is generally set up by an electric current which produces the "magnetizing force"; the resulting magnetic condition is measured in terms of the "magnetic induction." The ratio of the magnetic induction to the magnetizing force is the permeability. Materials which are readily magnetized have a high permeability, although permeability is not a constant for a given material but is different for various values of magnetizing force. The permeability increases with low values of the magnetizing force to a maximum value and then gradually decreases. Accordingly the magnetic induction does not increase indefinitely with increasing magnetizing force but reaches a constant maximum value or "saturation."

When the magnetizing force is removed, the magnetic induction or magnetism is not completely lost, a certain amount, known as the "residual magnetism," being retained. Permanent magnets are made of material such as a hardened tungsten steel having a high residual magnetism. For making electromagnets for which a strong field is required, as for instance in a lifting magnet, a material having a high permeability, such as wrought iron, would be used.

All of the magnetic properties of iron and steel are not only greatly influenced by the composition but also by the previous mechanical working and the heat-treatment of the material. In fact the magnetic properties of steel are measured in many cases in order to determine what the previous history of the meterial has been and to form an idea of its mechanical properties. Such tests can be applied to finished products without injuring them and in the future such tests may play an important part in the testing of metals.

Optical Properties

The mechanician is little interested in the optical properties of metals. For cases where a high polish is desired he generally knows what metals will answer his purpose. The ability to take such a polish, however, may be determined by physical measurements in terms of the reflectivity of the metal.

Probably many persons have observed that when an open hearth or Bessemer steel furnace is being tapped, the slag stream appears much hotter than the stream of molten steel. Such, however, is not always the case, since the difference in optical properties of the two streams could easily cause such an appearance. This property, the emissivity of the metal (or of the slag), is a quality which depends upon the color of the light through which the body is observed as well as the character of the metal surface. Emissivity can hardly be defined in simple terms, but a knowledge of it is important when making temperature measurements of hot bodies with an optical pyrometer, else erroneous results will be obtained.

After we have constructed a metal structure, we are of course interested in how permanent it will be, or what means must be used to secure its permanence. Corrosion is one of the worst enemies of metals and is always tending to destroy them. Some metals are quite readily corroded by the ordinary atmosphere, as evidenced by the rusting of iron and steel, while other metals require the strongest acids to attack them. Gold and the platinum metals are excellent examples of the latter class. Between the extremes there are many metals which are resistant to some corroding agents, but are subject to others.

The resistance to corrosion of an alloy cannot be predicted from the properties of the component metals but an indication can sometimes be obtained in such manner. Nickel resists atmospheric corrosion quite as well as do most of its alloys, some of which are extremely noncorrodable. Brass, composed principally of copper and zinc, is resistant in certain mixtures of the constituents and less so in others.

Impurities have a marked effect on the corrodibility of metals and alloys, sometimes increasing the effect and in other cases decreasing it. For example, small percentages of copper in sheet iron or steel appear to decrease the tendency to corrode in most atmospheres; while on the other hand, a small amount of tin in aluminum alloys is quite detrimental, the resulting alloy disintegrating in a short time, especially in warm moist atmospheres.

When two dissimilar metals are in contact and moisture, particularly salt solution, is present, there is a greater tendency for the metals to corrode than would be the case if there were no contact. That metal which is electro-positive to the other will be most rapidly attacked, the action being similar to that of an electric cell. A few years ago a yacht was constructed having a Monel metal (principally a nickel-copper alloy) hull, the Monel plates being riveted together by iron rivets and bolts. The yacht never left her dock, the iron rivets having all been eaten away by corrosion but the Monel was untouched. Had the rivets also been of Monel the yacht would probably still be afloat.

Since the atmosphere has such a deleterious effect upon many metals, it becomes necessary to protect the metal from the air and this is most readily accomplished by simply painting with ordinary paint, enamel or with oil. Metal coatings are also supplied, the most usual form being the familiar galvanized or tinned iron. It is well to point out here that unless the tin coating completely covers the iron base it is preferable that there be no coating at all. Iron is electro-positive to tin and if any pin-holes are present it can be seen from what was said above that the corrosion of the iron will be accelerated rather than retarded. Zinc, on the other hand, is electro-positive to iron and the effect of any incomplete covering of the iron base would be to corrode the zinc rather than the iron.

The weight of a structure often times plays an important part in the selection of proper material. The density of metals may be found in the tables which give directly the weight per unit volume of the material or the specific gravity, that is the ratio of the density of the metal to that of water. Where extreme lightness is desired, aluminum and its alloys are found quite useful, as they also possess remarkable strength. Lately, alloys of magnesium, which are still lighter than aluminum, have been introduced.

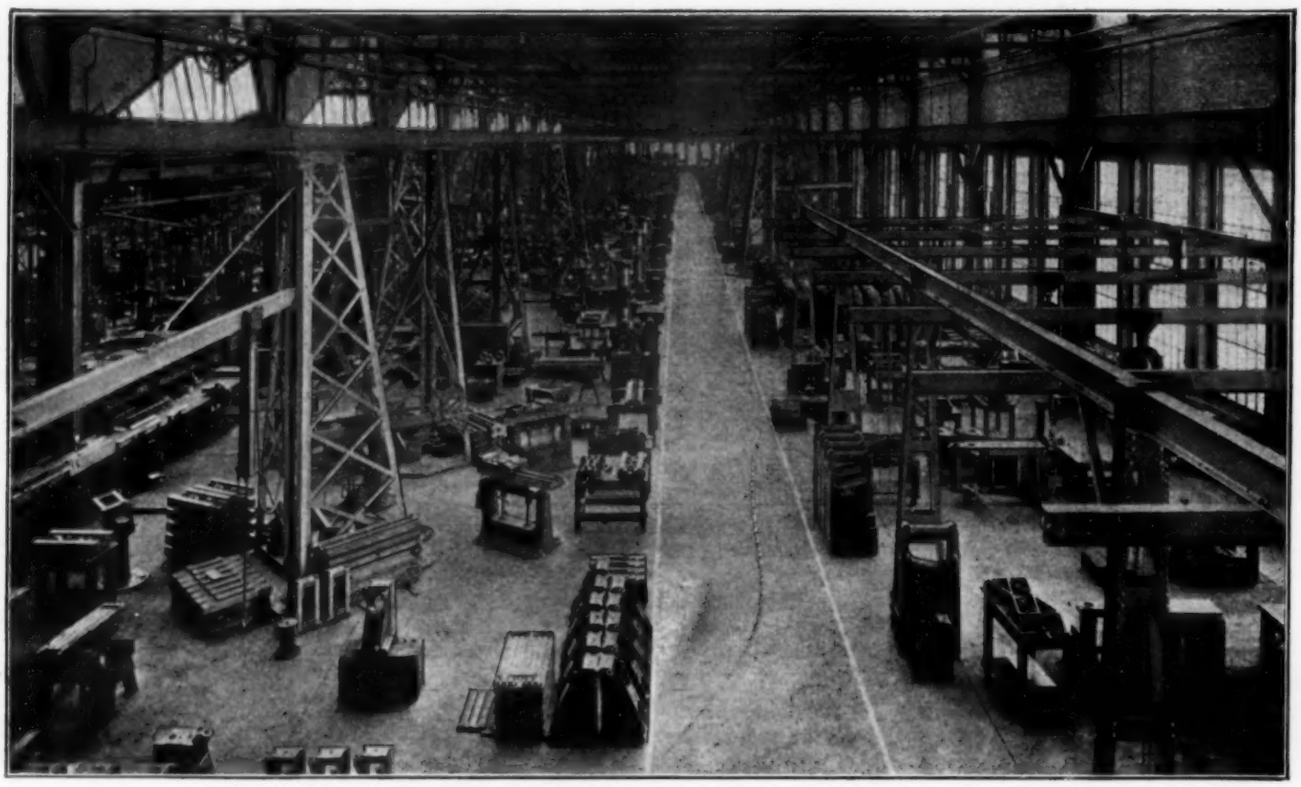
Jib Cranes in Assembling Work

SPECIAL CORRESPONDENCE

The illustration shows the assembling bay in the plant of the Cincinnati Milling Machine Co., this bay having much more headroom than the manufacturing space in order to allow for the runway for the large crane. The length of the bay is 725 ft., the span 58 ft., and there is a clearance of 16 ft. from the floor to the crane hook. Two cranes are provided, one a Niles of 5-ton capacity and the other made by Pawling & Harnischfeger of 7½ tons. The smaller crane has a speed of 250 ft. per minute on the runway and 500 ft. per minute for the trolley. The hoisting rate is from 40 to 60 ft. per minute. On the larger crane the speed of the bridge is 220 ft. per minute, of the trolley 350 ft. and of the hoist, from 30 to 60 ft.

At the right is a small craneway over the fitting and scraping floor. This is provided with a series of monorail cranes or trolleys equipped with 1 to 1½-ton chain blocks. In some cases direct air hoists are used.

On the other side are the jib cranes built with triangular bases and anchored at both top and bottom. These cranes are 1-ton capacity and the one in the fore-ground has a 1-ton direct lift air hoist. The arm is 15 ft. at a fixed height of 12 ft. from the floor.



USING JIB CRANES FOR ASSEMBLING WORK

Positive Lubrication of Machinery

The Adaptation of Automobile Grease Lubrication Methods to Machine Tools —Smaller Clearance in Bearings for Lubricant

SPECIAL CORRESPONDENCE

THE lubrication of machine tools is an ever present problem for every shop manager. There seems to be no question as to the failure of lubrication being at the bottom of most machine repairs, the cause of most of the idle time, when production ceases but overhead goes on piling up its quota of cost.

Something over a year ago this problem came up at the new plant of the Central Gear Works, Detroit, Mich. Machines gave trouble from lack of lubrication, while in some cases motors burned out because of too much oil, usually drippings from machine bearings above.

Special men were appointed as oilers to relieve the machine operators of all responsibility and trouble in the matter, but still some of the trouble hung on with amazing persistence. It so happened that one of the men responsible for machine maintenance, B. R. Secord by name, had been one of the first to use forced grease lubrication on his own automobile with great success. Having a few of the cup connections left over, he put them on a machine which had been giving trouble, and gave it a shot of grease twice a day. The trouble disappeared so completely that Samuel L. Ayr, the assistant general manager, ordered all machines which could be successfully lubricated in this way, equipped with the proper connections.

There are some machines and a few conditions where this system does not seem to apply. But these are few indeed, and on lathe spindles, bevel gear planers, drilling machines, grinding machines and the like the system is working out to the entire satisfaction of the management.

The main feature of the plan, which is known as the "Alemite" system and manufactured by the Bassick

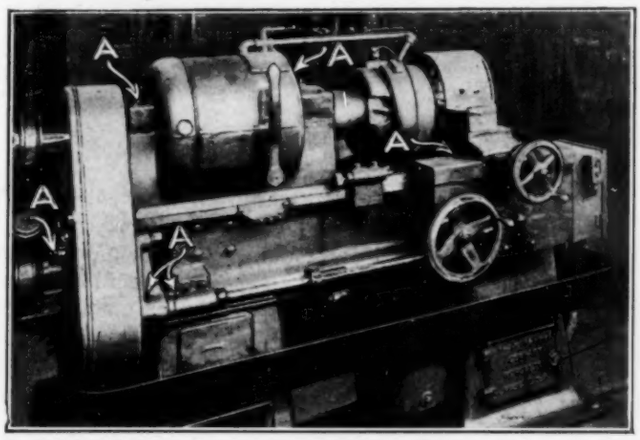


FIG. 1. REED-PRENTICE LATHE

Manufacturing Co., Chicago, Ill., is to use a screw pressure grease gun with bayonet joint connections for the parts to be lubricated. When the new grease is forced into the bearing it naturally and automatically forces out the old grease and any dirt which may have worked its way in.

One difficulty with the use of oil from a can is that the oiler naturally stops pouring or squirting when the oil overflows from the cup or pipe. If it is stopped up so that no oil gets to the bearings he has no means of knowing it, and goes on to the next machine believing he had done his full duty. With the pressure system, he turns the handle of the Alemite gun until the old

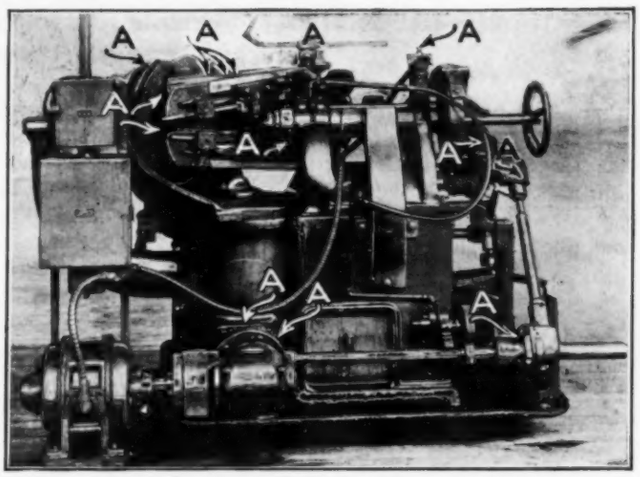


FIG. 2. GLEASON BEVEL GEAR SHAPER

grease is forced out of the bearings. Then he knows that the passage is clear and that new grease is in place in the bearings.

The comparative merits of oil and grease have been discussed many times. But all will agree that it is better to know positively that some kind of lubricant is between the bearing surfaces and the result which the Central Gear Works has secured with the use of grease on machine-tool bearings certainly makes it worth while investigating as a method for more general use, especially on exposed bearings.

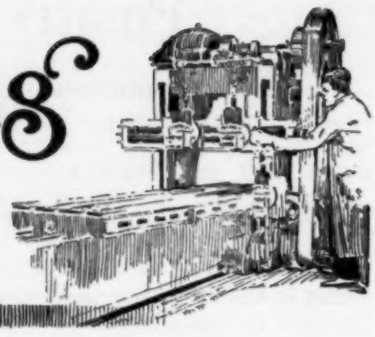
One interesting feature is that it has been found possible to run spindles with less clearance for lubricant than could be done when oil was used. This is not in accord with old time ideas and is all the more interesting on this account. Figs. 1 and 2 show two machines equipped for Alemite. The connections are shown by *A*'s.

It will be seen that the grease lubricant is supplied to sliding as well as to revolving surfaces in both the lathe and the gear cutter shown. No difficulty has been experienced from any tendency to lift the moving part off the ways as the grease can flow out of the ends. The pressure of the cutting tool or the weight of the part evidently thins the grease film to a fixed thickness which does not exceed oil. At least no trouble has been experienced from this source.

This is mentioned because experiments in lubricating planer ways by using oil under pressure, have indicated that it was an easy matter to float the table and so interfere with the accuracy of the work. Similar contingencies must be borne in mind in all new applications, but there has been no evidence of trouble from that source in any of the cases mentioned.

Metal Cutting Tools.

By A. L. DeLeeuw



XVII—Hollow Mills—Box Tools, Chisel Point and Ordinary Tools—Trephining Tools—Right and Wrong Methods of Using Roller Back-Rests

A HOLLOW mill is essentially a tube provided with cutting teeth at its front end. It is particularly adapted for turning up bosses and other projecting parts. Either the tool or the work may rotate. In appearance a hollow mill resembles a counterbore without pilots or shank. It has, however, certain characteristics by which we can recognize it and which are absolutely necessary to its proper functioning.

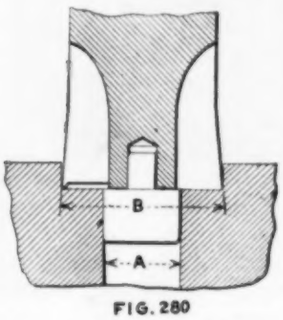


FIG. 280

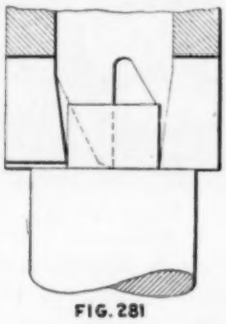


FIG. 281

FIG. 280. COUNTERBORED HOLE WITH COUNTERBORE AND PILOT. FIG. 281. HOLLOW MILL FINISHING BOSS

In Fig. 280 a counterbored hole is shown. The hole *A* was made first so that whether we use a counterbore with or without pilot there is no danger of the tool interfering with the metal toward the center because this metal has already been removed; but there was a possibility of the tool interfering with the metal on the outside of the hole *B*. In other words, the tool had to have clearance on the outside but not on the inside.

Fig. 281, on the other hand, shows the action of a hollow mill and clearly shows that the hollow mill requires clearance toward the inside but not on the outside. As soon as a hollow mill is resharpened its inside diameter becomes greater, so that unless something is done to overcome this handicap a hollow mill would be good for one grinding only. As a rule, this trouble is overcome by placing a collar around the projecting teeth of the mill. This collar may be provided either with a binding screw which permits of its being clamped tightly (see Fig. 282), or else it may have a number of setscrews, each one bearing on one tooth of the mill, or, as shown also in Fig. 282, a threaded collar on a taper body.

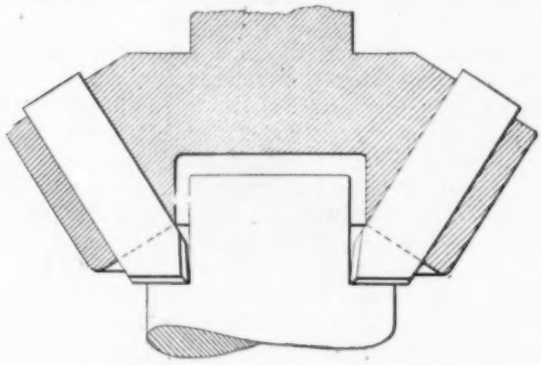


FIG. 283. BUILT-UP HOLLOW MILL

Another way of overcoming this difficulty and one which is often used where the tool is needed for quantity production is the following: Two tools are used, one for roughing and one for finishing. Of course the finishing tool has a smaller inside dimension than the one used for roughing. Naturally, the wear on the finishing tool is considerably less than on the roughing tool, so that one grinding of the former will correspond to several grindings of the latter. As a rule, enough tolerance is allowed on the piece to be hollow milled to permit of one or two grindings of the finishing tool,

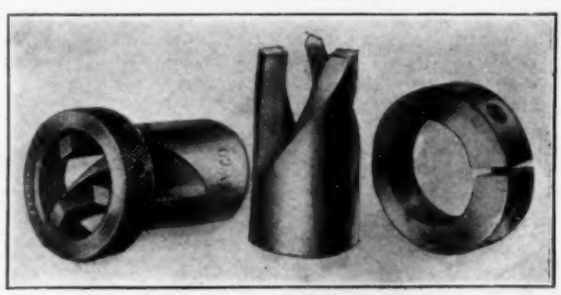


FIG. 282. HOLLOW MILL WITH ADJUSTING COLLAR

after which it is used for roughing. It should be kept in mind that a single grinding of a hollow mill does not increase the diameter very much. If, for instance, the clearance at the inside of the teeth is 3 deg., and we should grind off five-thousandths from the front of the teeth, we would increase the inside diameter one-half thousandth.

At the best, a hollow mill made out of a single piece of steel is a rather expensive tool and is, as a rule, not used in the larger sizes. Where larger diameters have to be turned built-up mills are used. Fig. 283 shows one of the many ways in which hollow mills are built up. In this case square pieces of steel are inserted in holes in either a grey iron or steel casting, or possibly a forging. Sometimes round steel is used for the tools and a setscrew bearing on a flat is supposed to hold them in the proper position. However, this method is not adequate for heavy cuts, as there would be a great

tendency for the cutting edge to turn away from the work and either cause too large a diameter or else cause the tool to cut with negative rake and excessive clearance, with resulting rapid dulling of the tools. In some cases plates are used, screwed on to the outside of a body and projecting far enough to allow the entire length of the boss or lug to be turned up without striking the body. The manner of constructing the hollow mill should be entirely dependent on the special conditions of the case. A facing head in which the tool has

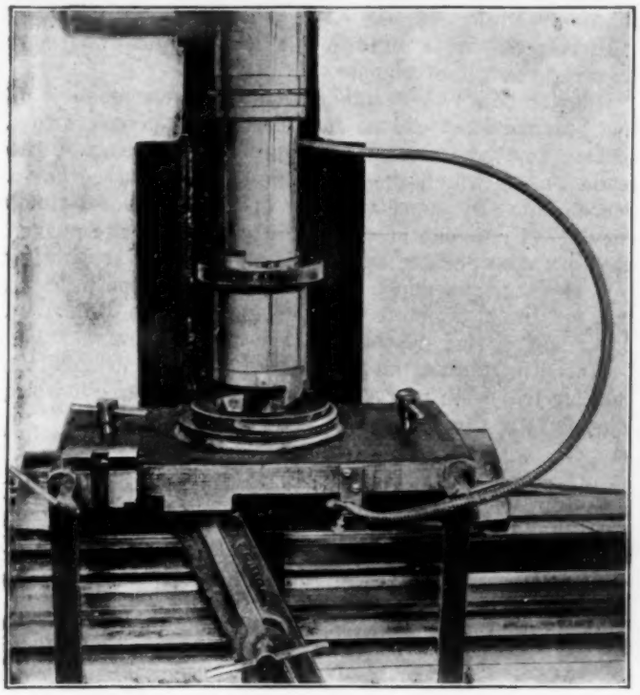


FIG. 284. HOLLOW MILL ROUGHING 75-MM. GUN RECOIL MECHANISM TRUNNIONS

an in and out motion or in which the tool gets its axial feed motion by the movement of the spindle may, in a way, be considered as a hollow mill. To many people a hollow mill is merely a turning tool which rotates while the work is standing still. In that sense, then, a facing head used for turning may also be considered as a hollow mill.

Hollow mills are very apt to cause chatter. In the first place, we are dealing here with broad nosed tools; as a rule, (almost always, in fact), with square nosed tools. Furthermore, the cut is divided between a number of these tools so that the feed per individual tool is very much reduced. Still further, a hollow mill is necessarily a poorly supported tool. It overhangs from a spindle, or possibly from a fixture, but in any case it does overhang. All these facts combined make the action of a hollow mill very unfavorable for smooth cutting and accurate size. Where the piece to be turned up is of considerable length, it will be found to be very difficult to keep it round or to size, and wherever possible a single point lathe tool should be preferred to the hollow mill if an accurate job is required. Nevertheless, there are a great many jobs where the use of the single point tool would be impossible or impractical, and there the hollow mill plays a very important role.

Fig. 284 shows an interesting hollow mill arranged to be guided in a large jig eye and used for rough-turning of trunnions of the recoil mechanism of the 75-mm. gun. It is particularly interesting for the way in which this tool was arranged to take very wide cuts in tough material and for the manner of inserting the blades.

A trephining or trepanning tool is used for boring holes without converting all of the metal of the hole into chips. The operation of trephining is particularly useful where holes of large diameter and short length have to be bored. Cutting out a piece of boiler plate by means of a tool in the spindle of a drill press is really a trephining operation. We often see the trephining operation in the toolroom where a fiber washer is required, but we hardly recognize the operation by this name. When trunnion rings or jackets for heavy guns are made it is often the practice to use solid forgings and trephine the inside part which leaves a very useful chunk of material for some other purpose. When trephining, the tool will have to clear both toward the inside and the outside and this is the chief difference between a trephining tool and a hollow mill. Stating the difference between counterbore, trephining tool and hollow mill once more, we have:

A counterbore must have clearance on the outside diameter.

A hollow mill must have its clearance on the inside diameter.

The trephining tool must have its clearance on both the inside and outside diameter.

Fig. 285 shows a trephining tool for relatively short work of large diameter, such, for instance, as the cutting out of the core of a trunnion ring. The toolhead is a heavy steel casting fastened in some way to the spindle of the trephining machine, which, by the way, is merely an extraordinarily heavily built drill press. The head has three arms, though of course any other number of arms might be used. The tools are broad blades, curved to correspond to the cylinder to be cut out and thicker in front than in the rear. This difference in thickness provides the necessary clearance Oblong holes are cored in the arm of the trephining head and the blades are set to the proper diameter by means of packing. In order to set all the blades to the same diameter and the same depth, one blade is put in first and then a shallow cut is taken with this one

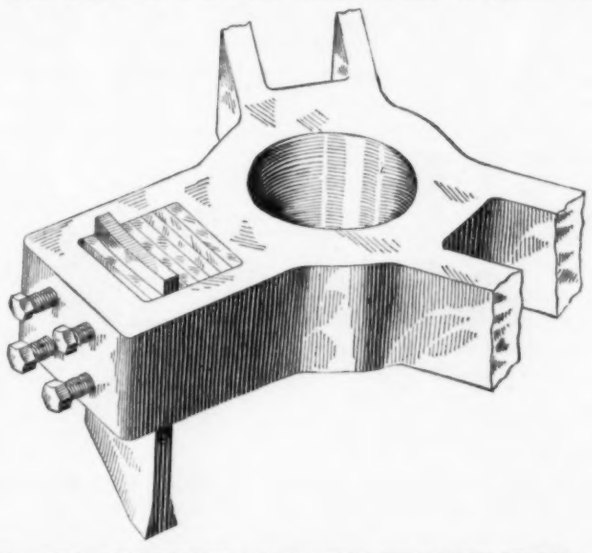


FIG. 285. TREPHINING TOOL FOR SHALLOW WORK

blade so as to make a groove in the work in which the other blades can be set. The entire arrangement and manner of adjusting are extremely crude. However,

tools of this description are not used for quantity production and the amount of time required to set such a tool is small compared to the total time required for the cut. The greatest difficulty to overcome with this arrangement of head is the grinding of the blades, which should have the same width at the cutting edge.

Fig. 286 shows a trephining tool as used for long work, such as the coring out of heavy castings or the

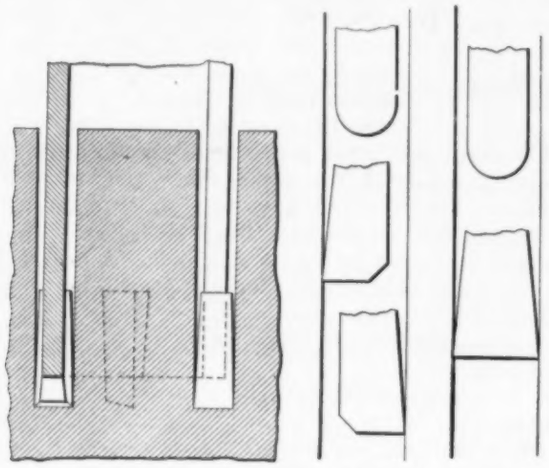


FIG. 286. TUBULAR TREPHINING TOOL FOR DEEP WORK.
FIG. 287. ONE WAY OF ARRANGING TEETH.
FIG. 288. ANOTHER WAY

making of cylinders out of solid stock. The tool is made out of a tube, preferably of some high-grade material, so as to keep the walls as thin as possible, and a number of tools are inserted in the front end of the tube very much in the manner in which saw teeth are inserted in large circular saws. The width of these blades must be considererably greater than the thickness of the tube, so as to make it possible for the chips to escape along the outside of the tube while oil under pressure is admitted to the inside.

The teeth of this type of trephining tool are sometimes made as represented by Fig. 287. Here the first tooth is of the round nosed tool type; the next tooth cleans up one side of the groove made by the first tool, and the third tool cleans up the other side. Sometimes

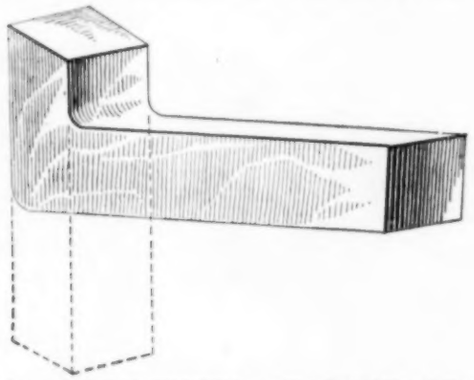


FIG. 289. SKETCH SHOWING DIFFERENCE BETWEEN CHISEL POINT AND ORDINARY TOOLS

they are arranged as shown in Fig. 288 where roughing and finishing teeth alternate.

It is essential to limit the rake of the tools so as to prevent the making of long chips. The small amount of rake and abundant clearance at the bottom or front end of the cutting edge causes short, compactly curled chips which, as a rule, can escape. Even with the greatest care it will be found necessary to withdraw the tool from time to time so as to prevent choking up.

It might be asked why the second arrangement of tool would not always be better than the trephining head first described. The advantages of the three-armed head are the following:

The cut is always open, so that there is no possibility of choking by chips.

It is possible to make tools for various diameters at relatively slight expense.

It is possible to vary a diameter slightly without requiring new tool blades.

Heavier cuts can be taken with this arrangement of tool because a cut can be started and can progress to a certain depth with a small amount of overhang of the blades, after which the blades can be readjusted for a deeper cut. By repeating this operation several times very heavy cuts can be taken until the blades are pushed out to a considerable depth. If the tubular trephining tool is used, the depth of cut is always dependent on the maximum amount of overhang of the tube. In other words, this depth is always a minimum.

Notwithstanding all of the above advantages the tubular tool is to be recommended for production work, especially if the work is of considerable length.

Box Tools

A box tool is not so much a special kind of metal cutting tool as a special arrangement of a tool. It is used for lathe work of relatively small diameter and where a tail center cannot be employed; in other words,

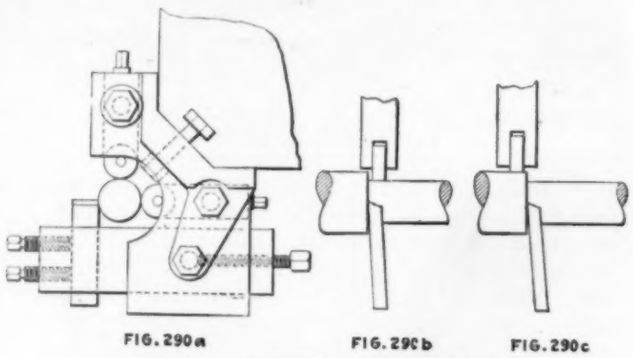


FIG. 290. A TYPICAL BOX TOOL

for screw machine work. The tool used is ordinarily the so-called chisel point tool. Though this type of tool is known by its special name, yet it cannot be said to differ in any essential from the ordinary lathe tool. Fig. 289 shows a forged lathe tool of the ordinary type and the dotted lines show how it would be transformed into a chisel point tool if the shank were attached in a different manner—that is, under, instead of back of, the cutting part. This shows that there is no real difference in the action of an ordinary lathe tool and chisel point tool.

When a heavy roughing cut is taken on an ordinary lathe the feed is, generally speaking, considerable as compared to the depth of cut. It is, for instance, quite common to use $\frac{1}{8}$-in. feed with a depth of cut of $\frac{1}{4}$ in. In screw machine work, however, we will find many cases of a deep cut with a relatively small amount of feed—for instance, where the hexagon stock for a bolt is reduced to the bolt size, and in many other cases. When such a cut is taken the feed probably does not

exceed 0.020 in. In general, in turret lathe and screw machine work the feed is small as compared to depth of cut for roughing work, and for that reason the chisel point tool is particularly useful. As practically all of the cutting is done on the side and not in front, it gives the looker-on the impression that a different kind of cutting action is taking place, but this is not so. The construction of a chisel point tool, merely a bar of steel ground at the end, lends itself particularly well for box tools.

The function of the box tool is to guide the work as well as to carry the cutting tool. In a sense it has the

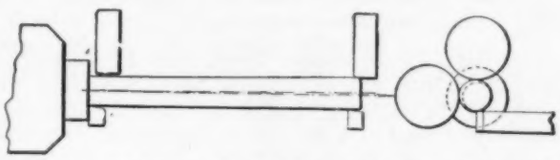


FIG. 291. EFFECT OF SETTING ROLLERS TOO FAR FROM WORK

same function as a hollow mill, except that the size of the work is determined here not by the relative position of three or more cutting points, but by the relative position of a cutting point and a back rest. In the case of a box tool the back rest can be arranged either as a "V" or with rollers. The advantage of the "V" is that it has no lost motion. On the other hand it has the disadvantage of introducing a great deal of friction and a tendency to score or mar the work, and for that reason the rollers are used more and more for a back rest. Fig. 290 shows a box tool as used on Gridley automatic turret lathes. As will be seen, each one of the rollers, as well as the tool, is independently adjustable.

In order to have ideal conditions each of the rollers, as well as the tool, must be at a distance from the centerline of the spindle equal to the radius of the work. It is rather difficult to meet this requirement. The "V" would seem to have the advantage because one needs to pay attention to one side of the "V" only. However, if it is located in such a way that one leg bears harder against the work than the other, there is no way of correcting the error, while the independently adjustable rollers offer an opportunity to correct any error which may have crept in.

The rollers, or for that matter the "V," of a box tool may be set either in advance of the tool or may follow,

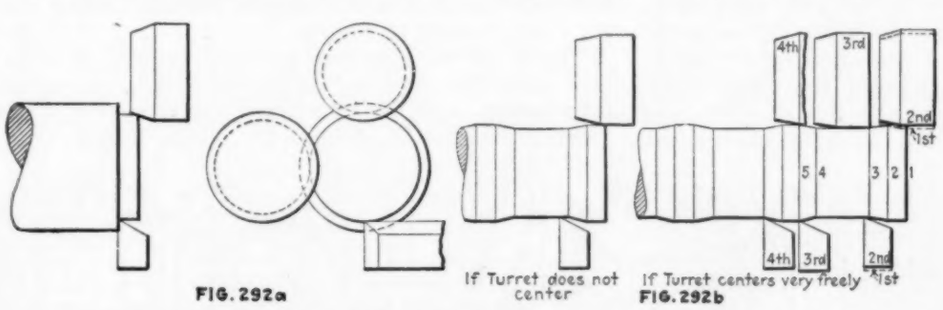


FIG. 292. EFFECT OF SETTING ROLLERS TOO CLOSE TO WORK

as indicated in Fig. 290b and 290c. The first arrangement has the advantage that the work is held before a cut is taken. The second has the advantage of the assurance that the piece against which the rollers bear is round and of even size. As a rule we cannot depend on the evenness of size nor on the roundness of the stock, nor can we be absolutely sure that the stock is held concentrically in the spindle; so that when a roughing cut is taken we should have the roller follow the tool. When, however, a box tool is used for a second cut, better results are obtained if the rollers lead, provided that there are no shoulders which make this method impossible.

Considerable difficulty is experienced when trying to produce an accurate piece of work with a box tool. The errors are, as a rule, relatively small, yet sufficient to cause considerable trouble unless great care is taken to avoid those conditions which are most apt to cause them. Among these conditions are eccentric chucking, lack of accuracy of spindle, lack of alignment between spindle and turret slide, looseness of turret and turret slide, and lack of accuracy in the setting of tool and rollers to correct diameter. The scope of this article does not permit of making a complete analysis of the effects of all these conditions, and only a few combinations will be indicated here. In the following illustrations the errors are grossly exaggerated because it is not possible to show them as they actually occur. However, the principle remains the same.

In Fig. 291 the rollers are set to a diameter somewhat larger than the diameter to which the tool is set. By this is meant that the distance from the roller to the axis of the work is too great. What will happen is indicated in Fig. 291. As the tool leads the rollers the pressure of the tool against the work will make the work spring until it rests against the rollers. As a result the instantaneous center of rotation of work at the beginning of the cut is some distance away from the axis of the spindle, the work is pushed against the rollers, provided it is slender enough to allow such an amount of spring, and the diameter of the front end of the work will be too large. As the cut progresses toward the spindle the pressure of the cut is no longer sufficient to spring the work enough to bring it up against the roller and the diameter of the finished work gradually decreases until at the spindle the diameter corresponds with the diameter to which the tool is set. The total result is that we obtain a piece of work which is of a larger diameter at one end than at the other. However, it will not be a straight taper. If, for instance, the work were very slender, a large portion of the total length might have been turned up with the same diameter as the front end. Finally, the taper will start, but this taper itself would not follow a straight line, but rather some curve more or less resembling a parabola. If, on the other hand, the piece had been of sufficient stiffness so that it cannot be pushed against the roller, even at the front end, the piece would have been taper over its entire length.

In the foregoing it was assumed that spindle, turret and slides were without any lost motion, and this assumption will also be held in the following where it is supposed that the rollers are set to a smaller diameter than the tool. Figs. 292a and 292b show this condition. Attention is once more called to the fact that the illustration grossly exaggerates the error.

Fig. 292a shows an end and a top view of the condition at the beginning of the cut. The tool being in the lead has cut a short distance of the correct diameter, provided the pressure was not sufficient to cause any material springing of the work, or, if the work were slender, the diameter at the end would have been somewhat oversize. The illustration shows the roller about to enter onto the work. The roller has either a tapered or a rounded leading edge. For the sake of simplicity this leading edge is shown tapered.

Fig. 292b shows what will happen at various stages when the cut is taken. The length 1—2 has been cut before the roller touches the work. As the taper part of the roller climbs onto the work the stock is pushed against the tool and compels it to cut to a smaller diameter than that to which it is set. The center of rotation, therefore, is no longer situated in the axis of the spindle. But after the cut is finished this center will spring back again to its original position. As a result of this action we obtain a piece, 2—3, which tapers down. For some length of time the diameter will remain unchanged. This length depends on the length of the cylindrical part of the roller. As long as any part of this roller slides over the portion 1–2 of the work we will turn a small diameter. When the back edge of the roller slides over the taper part 2–3 it permits the work to come back again to its original center of rotation, so that the tool passes over the part 4–5, and we will get the full diameter at the point 5, retaining this full diameter until the taper part of the roller once more pushes the work back as it passes over the taper part 4–5. This action will be repeated as long as the work is slender enough to allow of sufficient spring. If a cut must be taken close to the spindle, or on a heavy piece, so that such an amount of spring is no longer possible, a condition will be reached where either the machine stalls or something breaks down. As a rule the operator would discover this condition before anything serious happens. He would not be so likely to discover why a piece of work is of uneven size or rough, and he is liable to attribute the faulty work to almost anything before he realizes that tool and roller are not set to exactly the same diameter.

One gets the same result when the turret or slide allows a certain amount of movement rather freely, and particularly so if at the same time the work is springy. Under those conditions the tool starts in to cut the piece too large, both because the piece will spring away and because the turret will move away from the piece. Consequently the roller is compelled to move onto the piece under the same conditions as were described before, namely, that the piece is too large for the setting of rollers and tool. Whereas in the former case we started in with the correct diameter and the waves of variations would oscillate between correct and minus, in the case we are considering now we start in with a diameter which is too large and the size of diameter will fluctuate from plus to minus.

In order to minimize the bad effects of the weaving of the turret or spring of the piece it is well to take a starting cut with a box tool in which the rollers lead and take the greater part of the cut with another box tool in which the rollers follow.

(To be continued in next week's issue.)

International Fair at Riga, Latvia

Trade Commissioner H. Lawrence Yroves, Riga

The Riga International Fair, held from July 31 to Aug. 28, while not developing any important volume of immediate sales or orders, has been a success as an advertising opportunity for those working for future international business.

Agricultural machinery made up the most important exhibits—most of it of German origin, with plows, harrows, and cultivators especially in evidence. German-made mowing machines—virtual duplicates of a well-known American brand—were shown, as well as German thrashing machines and a large assortment of hand tools. The other most important groups were woodworking machinery and household utensils, also largely of German make.

German goods constituted 75 per cent of the displays by the 600 or more exhibitors. The Czecho-Slovak Metal Industry combine had a display of machinery. The only passenger automobile at the fair was the small French Citron exhibited by its Riga agency. A number of German motor trucks were on display. One American farm tractor was shown by its Latvian co-operative agency. English products were represented with one steam and one gasoline tractor and displays of textiles. The Scandinavian countries, Italy, France, Switzerland, Austria, and Poland had displays of one or more products.

An interesting exhibit by the Bolshevists during the last ten days of the fair included a good deal of handwork such as embroidery, coarse laces, and products of home industry. Rugs, some machine-made and some hand made, were evidently from pre-war times. There was a good display of furs and baled flax, with some leather of poor quality. Charts, diagrams, and maps indicated Bolshevist programs for child welfare and industrial production and development, including plans for electrification of Russia.

The Riga management proposes to hold a similar fair some time next spring, concerning which detailed information may be obtained by addressing Izstade (Exhibition), 24 Gr. Schloss Str., Riga, Latvia.

Machine Tools and Educational Institutions

Caldwell Act Gave Over Two Thousand Surplus Machine Tools to Schools—More To Be Available Soon—Applications Now Being Received

MACHINE TOOL users as well as machine tool builders, will be interested to know of the result of the Caldwell Act for the disposition of surplus government machine tools to educational institutions. The *American Machinist* welcomed the opportunity to do a real service to the machine tool industry, as well as to the educational institutions of the country, and it was its privilege to aid materially in 1919 in securing the passage of this bill.

While the original proposal was to lend the machines to colleges and schools, the plan finally adopted sold them at 15 per cent of their cost. As a result of this 2,408 machine tools are now in educational institutions in various parts of the country. Machines which cost the U. S. Government $2,145,022.25 were sold to schools for $321,753.34. They went to every state in the union, one even going to Porto Rico. A list of the schools taking advantage of this opportunity follows, and it is interesting to study the distribution. California leads with 314 machines installed for the education of her youth and is to be congratulated on the foresight displayed.

Here is the list:

Alabama: Alabama Polytechnic Institute, 5; Birmingham Board of Education, 14.

Arizona: Bisbee High School, 6; Phoenix High School, 28.

Arkansas: University of Arkansas, 10.

California: Alameda High School, 3; Berkeley High School, 2; University of California, 14; Chino High School, 2; Coachella Valley High School, 1; Colton High School, 2; Corona High School, 1; Coronado High School, 5; Fullerton High School, 8; Healdsburg High School, 10; Los Angeles City Schools, 27; Alhambra High School, 7; Oakland Public Schools, 106; Oakland Polytechnic College of Engineering, 4; Orange High School, 4; California Institute of Technology, 21; Pasadena High School, 5; Red Bluff High School, 3; Riverside Polytechnic High School, 1; Roseville High School, 2; San Bernardino High School, 2; San Diego High School, 2; San Jose High School, 3; California Polytechnic School, 2; San Mateo High School, 4; San Rafael High School, 2; Santa Ana Polytechnic High School, 6; University of Santa Clara, 1; Tamalpais High School, 19; Leland Stanford Junior University, 9; Stockton High School, 9; Whittier State School, 4; Fresno High School, 1; Chaffey High School, 16; Dinuba High School, 2.

Colorado: University of Colorado, 15; Pueblo High School, 2.

Connecticut: Connecticut Agricultural College, 21; Waterbury Vocational High School, 6; Norwalk, Public Schools, 4.

Delaware: Wilmington High School, 4.

District of Columbia: Bliss Electrical School, 8; Catholic University, 16.

Florida: Jacksonville High School, 4; Florida Agricultural and Mechanical College, 2.

Georgia: Americus Public Schools, 1.

Idaho: Twin Falls High School, 1.

Illinois: Lewis Institute, 15; Thornton High School, 13; Moose Heart School, 4; Ottawa High School, 6; Bradley Polytechnic Institute, 4; Peoria Manual Training School, 1; Rockford Board of Education, 8; Sterling Township High School, 6; Streator High School, 11; University of Illinois, 4.

Indiana: East Chicago High School, 1; Indianapolis Public Schools, 34; Purdue University, 22; University of Notre Dame, 2; South Bend Public Schools, 11; Rose Polytechnic Institute, 2.

Iowa: Cedar Rapids Vocational High School, 2; Davenport High School, 3; Sioux City Public Schools, 9; Iowa State Automobile and Tractor School, 8.

Kansas: Cherokee County High School, 11; Kansas State Agricultural College, 40.

Louisiana: Delgado Trades School, 8; Tulane University, 1; Louisiana Industrial Institute, 1; Southwestern Louisiana Industrial Institute, 14.

Maine: West Brooke School, 3; Bangor Public Schools, 1.

Massachusetts: Massachusetts Agricultural College, 1; Boston Trade School, 4; Boston Y. M. C. A., 17; Harvard University, 23; Massachusetts Institute of Technology, 108; Chicopee High School, 45; New Bedford Vocational School, 4; Norwood High School, 5; Springfield Technical High School, 11; Tufts College, 14; Westfield Boys Trade School, 9; Williams College, 2; Worcester Polytechnic Institute, 24; Quincy, Public Schools, 4.

Michigan: Adrian High School, 1; University of Michigan, 34; Detroit Institute of Technology, 6; Michigan State Auto School, 9; Detroit Northeastern High School, 1; Flint School of Automobile Trades, 1; Grand Rapids Board of Education, 41; Ironwood Public Schools, 1; Jackson High School, 14; Michigan Agricultural College, 33; Lansing Public Schools, 21; Menominee High School, 5; Saginaw Public Schools, 32; Arthur Hill Trade School, 5; Wakefield Public Schools, 5; Cass Technical High School, 13; Manistee School District, 4.

Minnesota: University of Southern Minnesota, 8; Independent School District No. 12, 1; William Hood Dunwoody Industrial Institute, 15; University of Minnesota, 21; St. Paul Public Schools, 2; St. Paul Y. M. C. A., 5.

Mississippi: Mississippi Agricultural and Mechanical College, 1.

Missouri: St. Louis Y. M. C. A., 11; Sweeney Automobile and Tractor School, 10.

Montana: Billings Polytechnic Institute, 4; University of Montana, 14; Flathead County High School, 2.

Nebraska: University of Nebraska, 7.

Nevada: University of Nevada, 2.

New Hampshire: Dartmouth College, 2.

New Jersey: Franklin Vocational School, 2; Rutgers College, 8.

New Mexico: Albuquerque High School, 6; State University of New Mexico, 1; Carlsbad High School, 1; Roswell High School, 3; Santa Fe High School, 1; New Mexico College of Agriculture and Mechanical Arts, 19.

New York: Alfred University, 11; Auburn Academic High School, 3; Pratt Institute, 25; Polytechnic Institute of Brooklyn, 10; Brooklyn Y. M. C. A. (Bedford Branch), 23; University of Buffalo, 2; Buffalo Y. M. C. A., 3; Elmira Vocational School, 2; State Institute of Applied Agriculture, 2; Hudson Industrial School, 2; Cornell University, 27; Kingston High School, 7; Hebrew Technical Institute, 1; Holmes Vocational School, 4; New York Y. M. C. A. (West Side Branch), 22; Niagara Falls Department of Education, 1; Olean Board of Education, 8; State Normal School, 3; Rochester High School, 20; Silver Bay School for Boys, 7; Solvay Schools, 1; Syracuse Y. M. C. A., 2; Rensselaer Polytechnic Institute, 9; Utica Free Academy, 8; Waverly High School, 1.

North Carolina: State College of Agriculture and Engineering, 11.

North Dakota: Hanson Tractor and Automobile School, 2; University of North Dakota, 12.

Ohio: University of Akron, 8; Cambridge Public Schools, 3; Canton Public Schools, 11; Canton Y. M. C. A., 18; Chillicothe Public Schools, 2; University of Cincinnati, 10; Case School of Applied Science, 23; Cleveland East Technical High School, 7; Cleveland University School, 4; Cleveland West Technical High School, 8; Cleveland Y. M. C. A., 48; Ohio State University, 5; Columbus Trades High School, 8; Columbus Y. M. C. A., 22; Dayton Y. M. C. A., 20;

Elyria Technical High School, 2; Sidney Public Schools, 3; Toledo Public Schools, 25; Toledo University, 4; Warren City Schools, 1; Antioch College, 6; Youngstown Y. M. C. A., 6; Shaw High School, 6.

Oklahoma: University of Oklahoma, 2; Oklahoma A. and M. College, 4.

Oregon: Portland Y. M. C. A., 12; Benson Polytechnic School, 17.

Pennsylvania: Polish National Alliance College, 6; Easton High School, 1; Erie School District, 32; Haverford College, 1; Philadelphia Board of Education, 6; Drexel Institute, 4; Spring Garden Institute, 16; Pittsburgh Public Schools, 14; Swarthmore College, 11; Washington High School, 8; Washington and Jefferson College, 7; Williamsport Public Schools, 9; York Public Schools, 20; Chambersburg School District, 6; Philadelphia Y. M. C. A., 8; Steelton Public Schools, 3.

Rhode Island: Rhode Island State College, 6; Westerley Public Schools, 2; Providence Trade School, 5.

South Carolina: Charleston Public Schools, 10; Clemson Agricultural College, 1.

South Dakota: South Dakota State Tractor and Auto School, 2; South Dakota A. and M. College, 5; University of South Dakota, 17.

Tennessee: Lincoln Memorial University, 9; University of Tennessee, 13; Vanderbilt University, 14.

Texas: Sul Ross Normal College, 3; A. and M. College, 6; Houston Public Schools, 2; Rice Institute, 1; Port Arthur School District, 1.

Utah: Granite School District, 1; Nebo School District, 1.

Vermont: University of Vermont, 3.

Virginia: A. and M. College, 12; Hampton Normal, 8; St. Paul Normal, 3; Maury High School, 5; Virginia Normal School, 17; John Marshall High School, 2.

Washington: Port Angeles Public Schools, 2; State College, 24; University of Washington, 4; Seattle Y. M. C. A., 8; Walla Walla High School, 4.

West Virginia: Benwood High School, 10; West Virginia University, 23; Wheeling Public Schools, 5.

Wisconsin: Beloit Vocational School, 9; Chippewa Falls Vocational School, 5; Eauclaire Vocational School, 2; Green Bay Vocational School, 3; Kenosha Vocational School, 8; University of Wisconsin, 49; Manitowoc Vocational School, 3; Menasha High School, 4; Stout Institute, 5; Milwaukee Continuation School, 41; Marquette University, 12; Neenah Industrial School, 3; Oshkosh Vocational School, 7; Racine Vocational Schools, 4; Marinette Vocational School, 11.

Porto Rico: Castro Technical School, 1.

Competition from British and Italian Automobile Manufacturers

WILLIAM I. IRVINE
Trade Commissioner, Automotive Division, Commerce Dept.

Reports that European manufacturers are seriously undermining Americans in overseas automotive markets are not borne out by the official export statistics. But the figures received do indicate that competition from two countries—England and Italy—is developing, and that to meet it successfully American manufacturers must support their export organizations at this time so that they may hold the positions won during the past year.

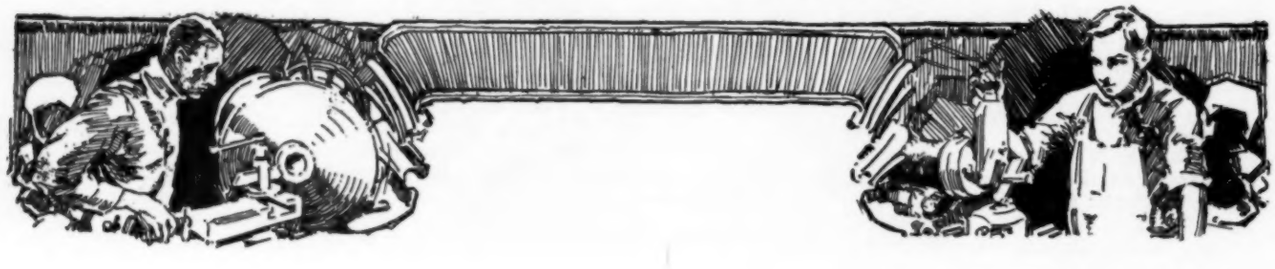
The most interesting phase of these statistics is that for the first three months of 1921 Italy shows in the total number of automotive vehicles shipped an excess over the same period in 1920; but, as automotive products in Italy are classified by weight, it is impossible to separate passenger from commercial vehicles in considering the excess. Italy's exports have grown steadily since 1919. In that year, during the first three months, 493 vehicles were exported, about half of which went to France and the remainder to Belgium, Portugal, and scattered countries. During the first three months of 1920 a total of 2,033 was exported, the greatest number going to Great Britain, Switzerland, Spain, and Algeria.

Growth of the Spanish Market

It is interesting to note that the exports to Spain developed from 17 in 1919 to 222 in 1920. The progress has continued in the first three months of 1921, when 314 were shipped. The total figures for the first three months of 1921 are 3,174, of which 652 went to Great Britain, 385 to Spain, and 210 to British India and Ceylon. The Indian development should be of interest to American manufacturers who believed that their principal competition in this market would come from Great Britain. This total of 210 was shipped during the first three months of this year, as against 119 for the corresponding period of last year. A comparatively small number of Italian vehicles have gone to South America, the total being 131 for Argentina and 55 to Brazil.

It is almost unquestionable that the low rate of the Italian lira is the important contributing factor to growing exports of Italian manufacturers. It is natural to assume that when Italian vehicles come into competition with products of American manufacturers the factor of price plays largely in the closing of sale. It would be to the interest of American manufacturers at this time to prepare sales arguments which would better fortify their representatives overseas to meet this kind of competition.

Exports of British manufacturers do not show a heavy falling off for the first seven months of 1921 as compared with the similar period for 1920, but it must not be assumed that this is because of a strong preference in overseas markets for British products. Last year Britain was not in a position to do very much exporting, because the demand for the home market was so great that manufacturers felt it obligatory to satisfy most of this demand before permitting exports. The number of cars shipped during the first seven months of 1920 was 2,916, as compared with 2,081 for the same period of 1921. The decline in the number of trucks exported is even less. The figure in 1920 was 2,045 as compared with 1,838 for the seven months' period of this year. The relative standing of America with Britain as an automotive export market may be judged from the fact that during the first seven months of 1920 America shipped 88,640 cars and 18,333 trucks, while in 1921, during the same period, 19,466 cars and 5,092 trucks were shipped.



The Schoop Process of Metal Spraying

Protective Coating of Metal Sprayed by Compressed Air—Impalpable Particles Discharged at High Velocities Penetrate Pores—Variety of Metals Can be Used

BY SPECIAL CORRESPONDENCE

WHILE the Schoop process of spraying metals for protective coating has been in use in European countries for several years, it is only lately that it has become a factor in the industries of the United States.

Two methods are used in the application of the spray in which the metals used may be lead, tin, zinc,

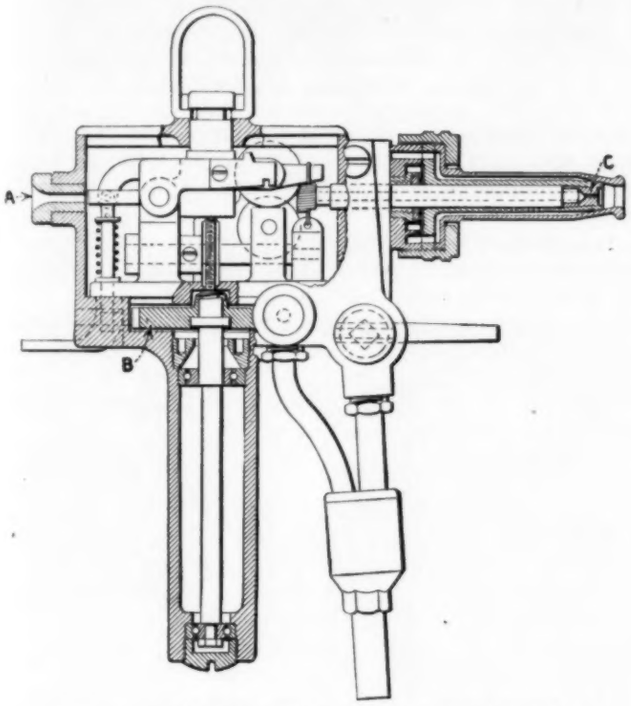


FIG. 1. SECTIONAL DRAWING OF THE PISTOL

aluminum, copper and nickel, Monel metal, bronze or other alloys, and the precious metals.

A gun or pistol weighing but 3½ lb. used in the first method is illustrated in Fig. 1. The metal to be sprayed is introduced at *A* in the form of wire and is fed continuously and uniformly at the rate of about 12 ft. per minute, through mechanism operated by the air-driven turbine *B*, to the muzzle *C*. Here the wire encounters a reducing flame of oxy-acetylene or oxy-hydrogen and is melted at a rate equal to the amount of feed. Under these conditions the end of the wire is melted a drop at a time and each drop, at the instant of formation is met by a blast of air at 50-lb. pressure, converted into spray and shot out in a diverging cone having a core of reducing gas and a surrounding sheath of air. The spray of metal being discharged at high velocity penetrates the pores of the object to be coated while still plastic.

ACTION SIMILAR TO THE AIR BRUSH

The pistol is essentially a metal-coating air brush, the spray from which covers a surface of about 2 in. in diameter at a distance of 5 in. from the muzzle.

The wire used is from No. 13 to No. 21 B. & S. gage. A single coating is about 0.001 in. thick though a coating of any thickness can be built up by continued application. It is claimed that a coating 0.003 in. in thickness, well-impacted on the surface, is as effective as a much thicker one.

For greater speed of operation where large areas are to be covered another method is used, employing the coating metal in the form of dust. The apparatus used in this method is known as the "Gravitas" gun and is shown in Fig. 2. A cylindrical container, holding about 20 lb. of powdered metal is fitted at the top with a removable cover to which is attached a pressure gage. At the bottom is a distributor through which the dust is forced by air at a pressure of 12 to 15 lb. From the distributor the dust passes through a rubber tube to the spraying tube or gun, from the muzzle of which it emerges between two concentric flame zones. The dust is heated to a plastic state and shot out onto the surface to be coated.

EXAMPLES OF WORK

In Figs. 3 to 5 are shown some of the applications of coating by the use of the pistol. Fig. 3 illustrates the coating of pipe for an oil pipe-line to be laid in the alkali fields of the Pacific coast, where an uncoated pipe line would be destroyed in a year. Fig. 4 shows the process being employed to protect the jaws of a street car frame. In Fig. 5 a pipe coil is being coated.

The use of the "Gravitas" apparatus is shown in Fig. 6 where the surface of a large drying plate is receiving a protective coating.

All metal surfaces to be coated should first be made clean, preferably by the sand blast process. When spraying indoors, particularly with lead or zinc, some

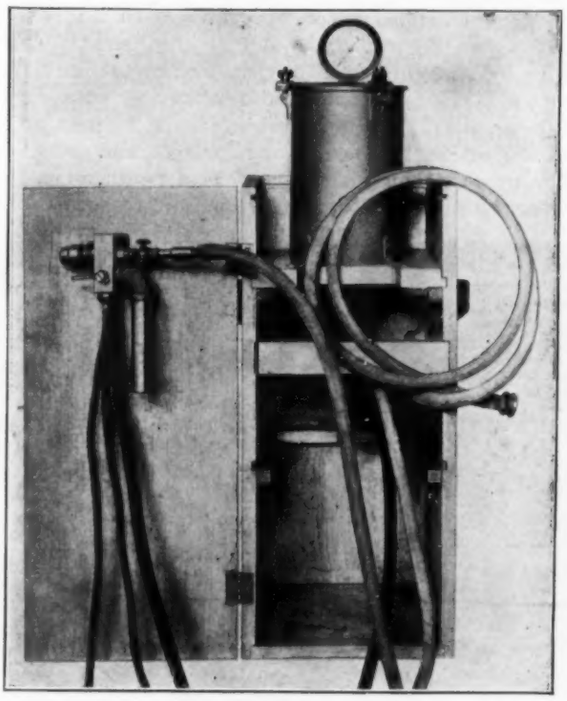


FIG. 2. THE "GRAVITAS" GUN

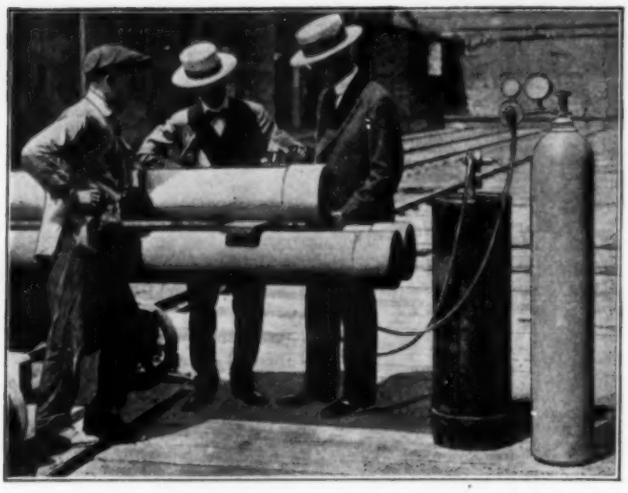


FIG. 3. COATING PIPE FOR A PIPE LINE

arrangement should be made to carry off the noxious fumes.

Protective coating is but one of the many uses of the metal spray. Copper can be deposited on carbon brushes,

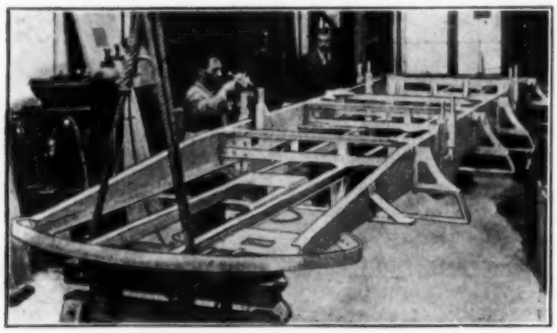


FIG. 4. PROTECTING PART OF A STREET CAR FRAME

also on portions of work to be carbonized and case-hardened in some parts while other parts are to be left soft; glass condensers can be coated with tin; wooden patterns can be preserved and strengthened for long service by spraying with any desired metal; radiators, stoves, etc., can be ornamented by spraying with various metals or alloys; seamless tubes can be formed of any thickness or length on cores or mandrels, and so on.

The process may also be used as a "putting on" tool for the building up of worn commutators and other

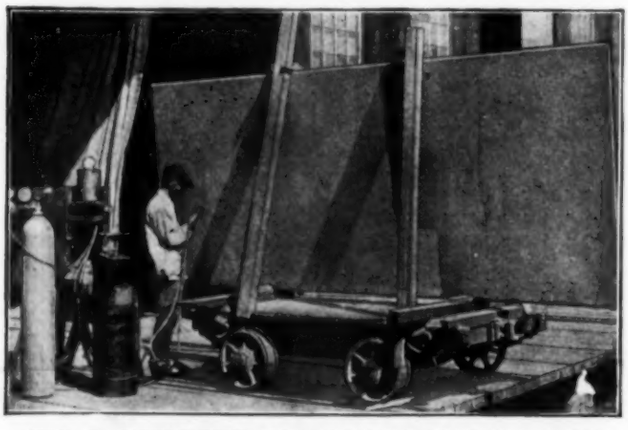


FIG. 6. USING THE "GRAVITAS" GUN ON A LARGE SURFACE

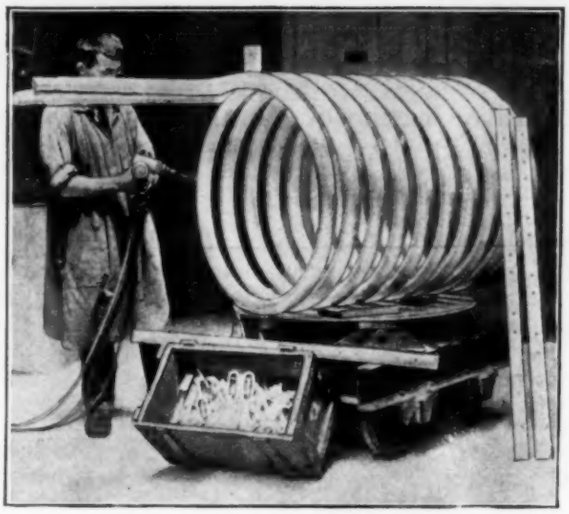


FIG. 5. SPRAYING A PIPE COIL

parts of machinery. Recently the piston rod of a very large hydraulic accumulator, worn so that the packing would not keep it from leaking, was successfully built up with Monel metal.

It is claimed that metals can be sprayed on fabrics or paper as the heat of the spray at 6 in. from the muzzle of the gun is not sufficient to ignite them.

The owner of the American rights for the Schoop process is the Metals Coating Co. of America, 495-497 North Third St., Philadelphia, Pa., to whom your correspondent is indebted for the illustrations and data used in the preparation of this article.

A Dangerous Experiment

It seems at this time that we are trifling with a particularly dangerous experiment in attempting to build a high tariff wall for the protection of our manufacturers. Europe is much more anxious to buy our goods than we are to buy hers. By placing a high tariff on her manufactured products, we are incurring the ill-will of her capital and her labor. In fact, the United States has today become more unpopular commercially than ever. In addition to that, we are still further decreasing Europe's buying power by making it almost impossible for her to sell goods to us. The most important item confronting us is to supply Europe with funds with which to purchase our commodities.

Our Future Linked With Europe's

It would seem that it devolves most strongly upon us to have our Government issue another large credit in favor of the foreign governments, going so far even as to remove the requirement that the proceeds of this credit shall be expended for the purchase of American goods. (It is a harmful fallacy to suppose that we can set aside the time-worn law of supply and demand.)

Let us not lose sight of the fact, whether we be Republicans, Democrats, or what not, that our future is linked indisputably with Europe, and that she helps us or hinders us according to the degree of prosperity or depression she is undergoing. We must remove to a great degree the backwash of Europe's financial difficulties by lending her a helping hand with her credits and our advice before we can hope to quickly regain our own prosperity.—Julian W. Potter, in *Forbes Magazine*, (N. Y.)

Ideas From Practical Men

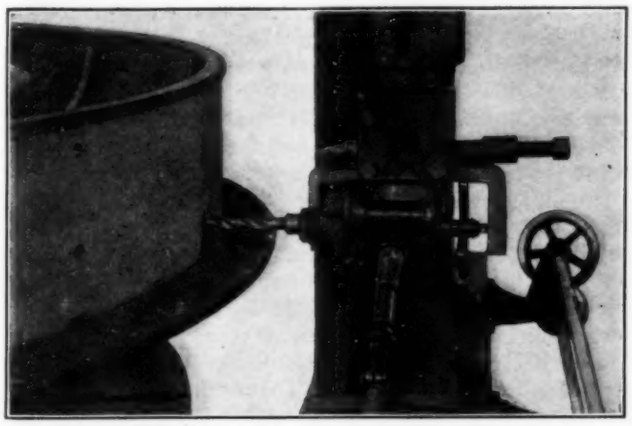
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Boring Horizontal Holes on a Vertical Boring Mill with a Pneumatic Drill

BY F. A. MCLEAN

It sometimes happens in shops doing a wide variety of repair work, that a piece will come in for drilling that is too large to be handled on any post or radial drilling machine in the plant. Such jobs are always a problem, the successful solution of which usually depends on the ingenuity and skill of the foreman in rigging up or adapting such tools and odds and ends as may happen to be available. A case in point which clearly illustrates the value of pneumatic tools for such work is shown in the halftone reproduction of the photograph herewith.

The brake ring on a large mine hoist was broken so badly that a new one was required. The casting for



BORING HORIZONTAL HOLES ON A VERTICAL MILL

this ring, or spider, was between 9 and 10 ft. in diameter and had to be bored and turned all over. This operation was done on a 14-ft. boring mill and the next step was to drill ninety-six $\frac{13}{16}$-in. holes through the rim (which was about $1\frac{1}{2}$ in. thick) to permit the bolting on of wooden friction pads or shoes.

Owing to the large size and awkward shape of the ring casting it was impossible to drill it on an ordinary drill press, so that it became necessary to seek some other way of doing the work. The old method of doing the job would have been to use ratchet drills, figuring on about twenty minutes per hole and adding the time lost in shifting the drill, setting up the "old man," etc., and would probably have required the services of two men for about thirty-two hours.

Drilling the casting on the floor with a pneumatic drill would have required the services of two men for eight hours, and in addition some time would have been lost in shifting the casting from the mill to the floor and vice versa. After the friction pads were bolted in place they had to be turned to form a good seat for the brake band and it was finally decided that the best way of doing the job was to drill it on the boring mill; thus saving the time which would otherwise be lost in moving the piece to and from the mill and resetting it.

A small pneumatic drill was clamped to one of the toolheads of the boring mill by a simple yoke. The cross and vertical movements of the toolhead were used for feeding and adjusting the drill up and down, while the table was revolved from time to time as required, thus acting as a sort of indexing device insuring the proper location and alignment of the holes.

The actual drilling time, using the equipment illustrated, was eight hours for one man. The holes were all drilled true and very little time was consumed in shifting the drill. One and one-half hours was saved in moving the casting to and from the mill and half an hour for resetting the piece to turn the brake pads after they were bolted on, thus saving approximately twelve hours over the estimated time required for two men to drill this piece on the floor with a pneumatic drill.

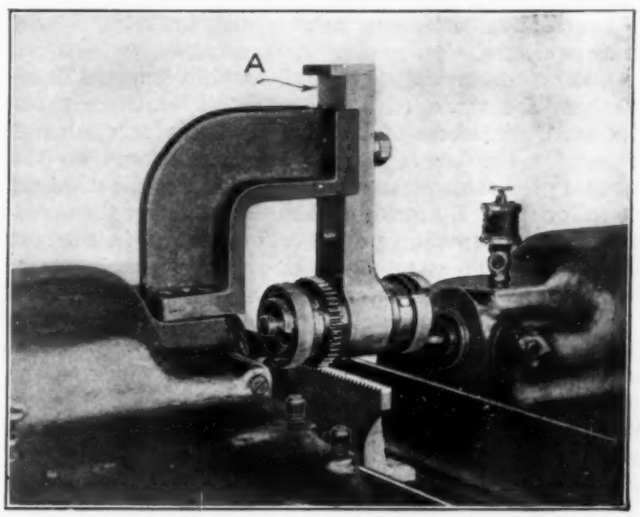
It is obvious that the equipment shown could be adapted to boring large horizontal holes by using a portable boring bar suitably geared to the pneumatic drill chuck instead of an ordinary twist drill. Such an arrangement would be of value in repair shops not equipped with a horizontal boring mill or where it is desirable to have both vertical and horizontal holes bored in large pieces at one setting.

Rotary Slot Milling Fixture

BY J. M. HENRY

A clever arrangement for rotary slot milling is shown in the accompanying illustration. The machine used is the regular Pratt & Whitney 47-in. spline milling machine, and the fixture was designed and is used by the United Shoe Machinery Co., of Canada.

The arrangement consists of a rack, adjustable for



DEVICE FOR MILLING CIRCULAR SLOTS

height, bolted to the regular table and meshing with a gear that drives the work spindle. A bracket is screwed and dowelled to a milled-off portion of the right-hand spindle head of the machine, and in this bracket is a vertically adjustable slide that carries the work spindle. The latter is double ended, so that both of the machine spindles may be utilized to mill slots in two pieces at once.

As the work spindle is raised or lowered to secure the proper slot radius, the rack is adjusted up or down to compensate. The work is held in place by slip washers clamped by a through bolt with nuts at each end. The fixture has a capacity from 0 to 3½ in. radius, and the setting is obtained to any degree of accuracy by inserting size blocks at *A* between a ledge on the slide and a surface ground on the bracket. Either a whole circle or any part thereof can be milled by adjusting the length of stroke on the reciprocating table. The regular range of feeds on the cutter and the speed of the table stroke, both cam controlled, are available without change.

Method of Casting Long Babbitt Lined Nuts Without Shortening the Lead or Reducing their Diameter

By Martin H. Ball

Difficulty is generally experienced in casting babbitt metal linings in long nuts, due to the shrinkage of the metal in cooling and the consequent change of lead in

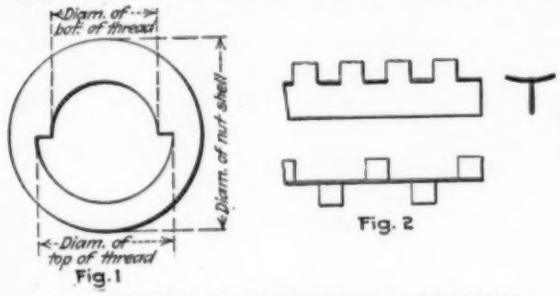


FIG. 1. WASHER FOR SEPARATING SECTIONS TRANSVERSELY
FIG. 2. SEPARATOR TO BE PLACED LENGTHWISE OF SCREW

the thread, causing the nut to bind on the screw; a trouble that is further aggravated by shrinkage in diameter.

The lead difficulty can be overcome by using one or more washers, shown in Fig. 1, as may be required to make sufficient divisions in the babbitt lining. These washers are made of ordinary detail drafting paper for small diameters of nuts, and of heavier grades of paper for the larger sizes They are placed on the screw in the same manner as a nut at intervals of about 1½ in. or less. By making them fit closely on the screw and into the opening provided for babbitt in the nut shell, they will stand straight and keep their places while the babbitt is being poured.

To prevent the shrinkage in diameter the babbitt metal must be separated, parallel to the axis of the screw, into blocks not to exceed 1½ in. in width on the larger sizes of nuts, and into at least four sections on small sizes. This can be done by using the same paper recommended for the washers; cutting and forming it as shown in Fig. 2 to fit the screw and the opening provided for babbitt.

A simple method of handling the smaller sizes of split nuts is shown in Fig. 3. The paper spacers *A* and *B* are clamped in place between the half nut parts as shown; the nut is placed in a horizontal and level position and the babbitt metal poured up to the center line *CC* and allowed to cool sufficiently to take a permanent set. The upper sections are then poured, thus

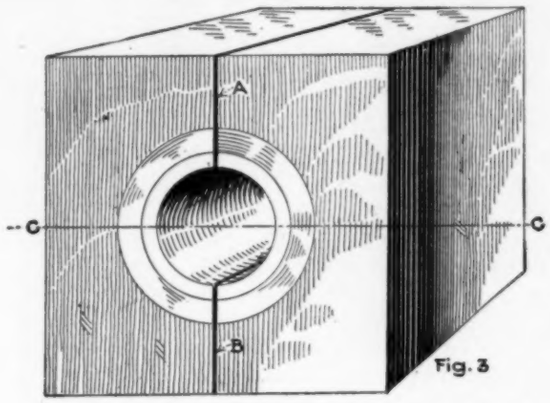


FIG. 3. METHOD OF CASTING SMALLER NUTS

forming a parting line or what is commonly called a cold-shut on line *CC*.

The interval of time between the pourings need not be long to accomplish this result, and both pourings may be done at the same heat. This method of separation can be used on larger sized work where it is necessary to divide the nut bearing into several sections by using one separating piece and rotating the nut on the axis of the screw until the required point of the adjacent separation piece is in a horizontal position.

The first pouring is then made and as soon as the metal sets the procedure can be repeated until the complete lining is cast. Care should be exercised to always have the line which the babbitt metal takes when the pouring is stopped, both radial and horizontal.

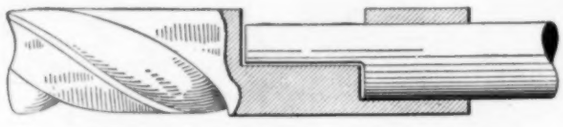
The sections of babbitt metal should in no case be over 1½ x 1½ in. and each section must be provided with its individual anchorage to the nut casing and not depend on any support from adjacent sections, as the shrinkage always makes some space between them.

An Interlocking Drill Extension

By C. Davies

A drill extension that can quickly be made, does away with the troublesome soldering method usually employed, and can be depended upon to drive the drill, may be constructed as shown in the sketch.

A hole is bored in the end of the drill-shank that is a push fit for the rod to be used, and the end of the



EXTENSION FOR SMALL TWIST DRILLS

latter is flatted off to half its diameter for a short distance. A slot is now filed across the drill just below the end of the axial hole and the rod driven in, the flatted off portion passing beyond the bottom of the hole and engaging the slot in the drill, thus insuring a positive drive.

EDITORIALS

The Unemployment Conference Progresses

RUNNING true to form under the masterly direction of Herbert Hoover, the Washington Unemployment Conference has accomplished two of the three things it set out to do. It has figures on actual unemployment which are fairly accurate, something we have never approached before. The importance of accurate statistics can hardly be exaggerated as almost all relief measures must wait until the extent of the trouble is known. The original Department of Labor figures were hopelessly inaccurate and the announcement of an unemployment total of 5,700,000 did far more harm than good. We understand that steps are being taken to make possible the securing of reliable statistics of this nature at all times.

As to the second step, that of recommending the procedure to be followed in remedying this winter's emergency, certain drastic steps have been decided upon by the conference and given to the public. More important, however, is the recognition of the fact that the "buck" passed to the Federal Government by the various committees must be passed back again with definite instructions and offers of aid in handling each local problem. As a result of this move a steadily growing number of cities (forty-two as this is written) have embarked on positive relief plans and are making encouraging progress in decreasing the number of unemployed.

The third purpose of the conference, the formation of a policy toward unemployment in the future, is still in committee, but the bits of information that have leaked out indicate that sane suggestions will be offered in due time.

The conference, of course, has no power to go beyond the suggestion and recommendation stage; an awakened public conscience must take action. It has, however, ascertained the facts and indicated the remedies as far as it has gone. The vision and faith of President Harding and Mr. Hoover have been justified.

Engineers and International Peace

AN unusual gathering has just been held in New York. It was a welcome-home banquet to the delegation of engineers from the four founder societies, the Engineers' Club and the Federated American Engineering Societies which went to England and France to bestow the John Fritz Medal on Eugene Schneider and Sir Robert Hadfield for distinguished achievement in the field of engineering.

It was evident from the accounts of their experiences given by members of the delegation, that the spirit of cordial co-operation between the American engineering societies which made the trip possible, made a profound impression on the European engineers. It is not too much to hope that as a result of the visit some sort of international organization of engineers may result.

What may develop from such an association was beautifully expressed by the chairman of the delegation, Ambrose Swasey. Mr. Swasey looks forward to "engineering association and co-operation that will create bonds which will so unite the three countries that there will be little for the diplomats to do or undo to keep the peace of the world."

After all, will not such international association of engineers, of business men, of citizens, go far to make future wars impossible? Community of interest is a great discourager of disputes and may well be considered by the statesmen and others who sit down together in Washington next month to discuss disarmament.

Is This the Time to Spend Millions for Dirigibles?

NOW that the first shock of the tragedy of the ZR-2, whereby a number of naval officers and men of both Great Britain and the United States lost their lives, is over, we can view the whole deplorable matter with a better sense of perspective. It points out the dangers of using inflammable gas in connection with a motor-driven airship and the hazards which attend the pioneering of any new mode of travel. It also emphasizes the tremendous amount of money tied up in a single experiment.

Leaving aside the question of proper or improper design, for this is a new field of engineering, the necessity of using non-inflammable gas for passenger-carrying airships is shown to be imperative. This we realize imposes a heavy handicap on the dirigible, as helium gas is not only expensive but is scarce as well. We do not allow explosives or inflammables on passenger-carrying steamships where the danger is much less than in the air. If the navy demands dirigibles, the present gas but adds to the hazards of war. But no airship should be permitted to carry passengers unless it uses helium or some other non-inflammable gas.

While the question of cost is subordinate in the face of the loss of life, it must nevertheless be carefully considered. The cost of the ZR-2, no matter who pays it, would purchase many airplanes and allow for much development in that line. The cost of the single hangar at Lakehurst, N. J., variously stated at from $2,000,000 to $6,000,000 would build many landing fields. The four or five hundred men required to guide a giant dirigible into its hangar would man the landing fields which could be equipped with the cost of the hangar at Lakehurst.

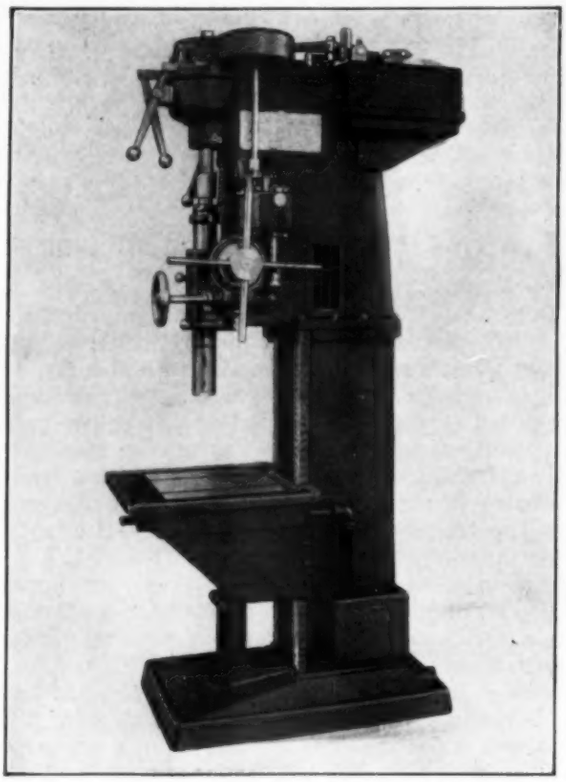
The dirigible may have its place in the transportation of the future. But its progress to date has been very slow and very costly both in lives and money. The great drawback of involving such huge sums in a single experiment, which is unwieldly at best and dependent on the wind and weather to a far greater extent than the airplane, makes this an inopportune time to spend further millions in that direction.

Develop the airplane by all means, along sane lines which will aid in its adoption for commercial purposes. But the further expenditures of millions for such hazardous experiments as the ZR-2 should not be permitted at this time.

Shop Equipment News

Baker Light Heavy-Duty Boring and Drilling Machine No. 121

In the accompanying illustration is shown the No. 121 drilling machine recently placed on the market by Baker Bros., Toledo, Ohio. The machine is known as the



BAKER NO. 121 HEAVY-DUTY DRILLING MACHINE

light, heavy-duty type, and is intended for driving drills from ⅜ to 1½ in. in diameter, as well as for such work as boring and facing.

The machine can be furnished as either a single-purpose or a quick-change drilling machine, the former lacking the gearing of the latter. If it be desired to make a quick-change machine out of the single-purpose one, it is only necessary to add the additional parts, the head being completely bored and drilled for them.

Tight and loose pulleys are mounted at the back of the machine and supported by brackets cast integral with the head, the shaft running on roller bearings. By this means wide-face pulleys can be used, without sacrificing the possibility of placing the machines in gangs with close center distances. The machines can be furnished in gangs with a dimension of 18½ in. between the spindles.

All control levers are placed so that they can be conveniently reached by the operator when standing in front of the machine, and their positions are said to be such as to enable the speedy operation of the machine. All gears in the speed train are hardened. By using transposing gears for both the speed and feed trains, in connection with the sliding quick-change gears, practically any number of combinations of speeds and feeds can be obtained to suit special jobs. The machine can thus be effective with small as well as large sizes of drills or tools. It is stated that a 4-in. pipe tap has been successfully driven on it.

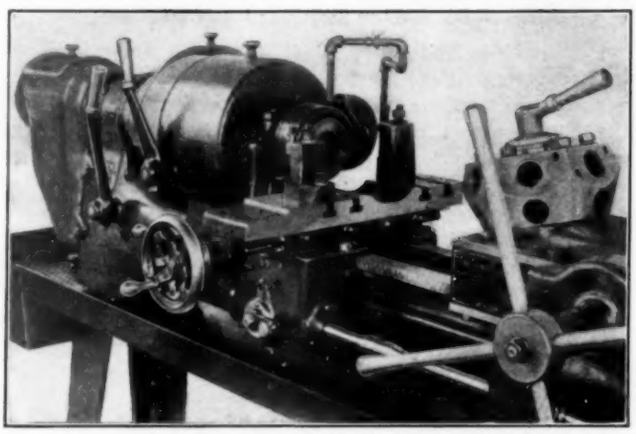
The machine is provided with an over-counterweighted spindle, and a device which absorbs the inertia of the return of this spindle at the top of the stroke. This device is said to increase production, because no effort on the operator's part is required to disengage and withdraw the tool and spindle from the work. The machine is stopped and started by means of the tight and loose pulleys, a spring device holding the belt in place. In the off position a brake is applied automatically, so as to stop the spindle.

It is stated that practically any speed can be obtained by the use of slip gears. The standard speeds are from 144 to 468 r.p.m. for the single-purpose machine, and from 38 to 632 r.p.m. for the quick-change machine. The feed on the single-purpose machine can be varied from 0.006 to 0.1 in. per revolution by the use of slip gears, although 0.008 and 0.025 in. are the standard feeds. On the quick-change machine, ten changes of feed are ordinarily provided, the minimum being 0.008 in. and the maximum 0.094 in.

The plain table is of the box knee type, raised by means of a telescoping screw. A compound table having screw adjustments can be furnished. Various attachments and modifications can be provided, such as a tapping reverse, multiple-spindle head, motor drive, oil pump and gang assembly. The floor space is 22 x 36 in., and the weight 2,100 lb.

Power Crossfeed for Tilted Turret Lathes and Screw Machines

A power crossfeed to the cut-off slide has recently been developed for the Nos. 2, 3, 4, 5 and 6 Tilted Turret lathes and screw machines, manufactured by the Wood Turret Machine Co., of Brazil, Ind. The design of the cross-slide allows of casting the apron or gear box integral with the saddle proper, which insures rigidity as well as permanent alignment of these parts.



TILTED TURRET LATHE WITH POWER CROSSFEED FOR CUT-OFF SLIDE

The arrangement of the slide is shown in the accompanying illustration, the machine itself being similar to the one illustrated on page 320, Vol. 49, of the *American Machinist.*

The power is transmitted to the feed screw by means of two bevel gears on the lower feed shaft meshing with a third gear on a vertical shaft, thence through helical gears to the feed screw. The single-lever control allows of feed engagement in either direction. When the lever is in a vertical position the feeds are disengaged, while throwing it to the left causes the slide to travel in, and to right to travel outward. Six feed changes, ranging from 0.003 to 0.023 in. per revolution of the spindle are provided, any feed being instantly available without stopping the machine.

Provision is made to safeguard the feed mechanism against overload or accident, by a brass shear pin on the lower feed shaft. The bronze feed nut is of the solid flanged type and is held in place by two capscrews. Since it is bolted to the back side of the saddle, it can easily be removed without disassembling the other parts.

A large dial, graduated to 0.001 in., is fitted on the handwheel. The feed screw is provided with two bronze bearings in the outboard end of the slide. The back lash of the feed screw is taken up by means of a knurled adjusting nut, which is locked by a handwheel. Positive screw stops are mounted at the front and rear to control the depth of the cut when using forming tools.

Bridgeport Cylinder Refinishing Machine

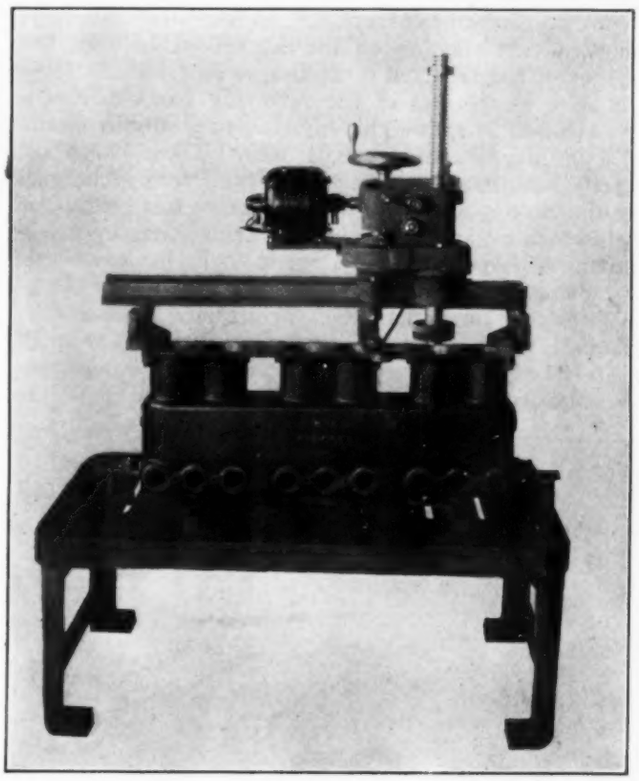
A machine for the reboring and refinishing of the bores of automotive cylinders has recently been placed on the market by the Bridgeport Cutter Works, Inc., 50 Remer St., Bridgeport, Conn. It is electrically driven and is portable; it is also said to be adapted to all makes of automobile cylinders, and to be very speedy in its operation.

The machine consists essentially of a sliding head supported on a guiding way that is carried on the top of the cylinder block by means of suitable brackets. Provision is made for adjusting the way in line with the center of the cylinder, by means of an indicator. The head carries a cutter bar held in large bearings. This bar is centered over each cylinder in turn by the aid of an indicator, and an additional clamp is provided for supporting the head close to the point where the cutter is working.

The bar is driven at slow speed through reducing gearing, by means of an electric motor, the latter being of such a size that it can be driven from any lighting circuit. A geared power feed of about $\frac{1}{32}$ in. per revolution is provided. It is possible to disconnect the feed, so as to raise and lower the bar by hand. The machine is provided with an indicator and a holder for it, as well as various sizes of bolts, stops, clamps and studs with which to mount it. Cylinder blocks having removable heads can be left in the chassis of the automobile while the refinishing is being done. However, in the case of closed-head cylinders, it is necessary to remove them from the chassis. The stand shown in the accompanying illustration is furnished for mounting the cylinders while the cutting operation is being performed.

The type of cutter or reamer employed resembles that described on page 624, Vol. 54, of *American Machinist.* It is known as the "Herri-Stag" and consists of two herringbone cutters, the teeth of which are staggered. The bottom cutter, which does the roughing, has its teeth cut with a right-hand helix, so that it will bite into the glazed surface likely to occur in the bore. The finishing cutter is slightly larger in diameter, and has a left-hand helix, so that its teeth act chiefly as scraping tools. It is stated that the finishing cutter serves as a guide for the roughing cutter and helps to maintain the hole true.

The cutters can be furnished for practically any make of automobile cylinder, being provided with the standard oversizes of 0.010, 0.015 and 0.020 in. The sizes vary from about $2\frac{3}{4}$ to 4 in. Since the cutters



BRIDGEPORT CYLINDER-REFINISHING MACHINE

can be ground down to serve for smaller sizes, it is stated that their upkeep cost is small. The maker claims that the holes produced are true to size and straightness, and that in finish they compare very favorably with ground holes.

"Precision" Balancing Machine

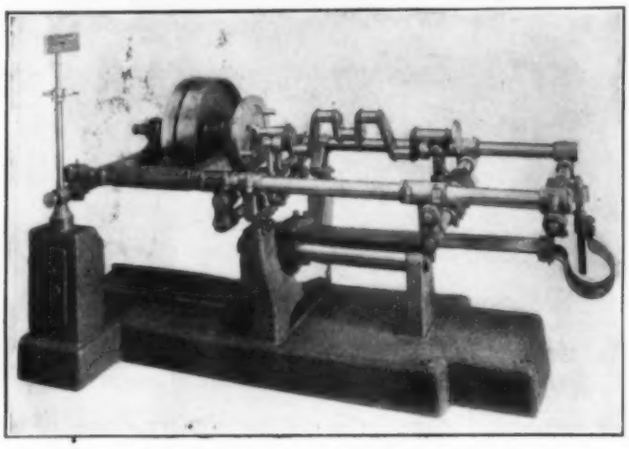
The illustration shows a balancing machine recently placed on the market by the Precision Balancing Machine Co., 3020 E. Franklin Ave., Minneapolis, Minn. The machine is said to apply the principles of dynamic and static balancing invented by B. L. Newkirk, so that it is possible to obtain complete dynamic and static balance by two single corrections, individually measured and located near the ends of the body. The determinations are, it is stated, made by a procedure producing the required result irrespective of the skill of the operator; and when duplicate parts are to be balanced in production, great rapidity can be attained, as static balancing is rendered unnecessary and the operator has only a few simplified steps to perform.

A spring-mounted and pivoted frame carries a special type of headstock and adjustable rollers to support the work. By the form and location of the springs, a free

vertical vibration of the overhanging right-hand end of the frame may take place about the pivot springs as a fulcrum point. All revolving parts, including the rollers which support the work, are mounted on ball bearings. A speed of rotation above the "critical speed" of the frame is first used, and the driving power is then disengaged, permitting a gradual diminution of speed down to and through the critical speed of the frame At this point there occurs a maximum vibration, which is proportional to the correction required in the overhanging end of the work, irrespective of any unbalance having a single resultant in the plane of the pivots. From the observation on the dial indicator, mounted part way up on the column at the left, the amount of the required correction is determined.

A disk at the left of the revolving parts carries a standardized 10-oz. weight, adjustable radially by means of a vernier reading to 0.01 inch. These parts are exactly balanced when the weight is at zero. The disk is adjustable to any angle with reference to a protractor dial, which engages the other revolving parts by a jaw clutch. This permits adjustments to be made without first bringing the work to rest.

With the correction thus arbitrarily applied, the system is again speeded up and allowed to pass through the critical speed as before. The second amplitude bears a relation to the first amplitude dependent on the



"PRECISION" BALANCING MACHINE

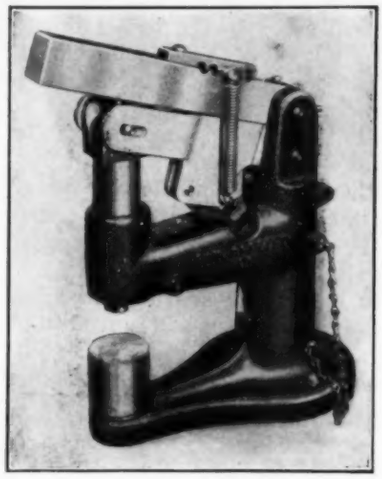
angle between the point of application and the point required After determining and setting off this angle, a third run will check the result. For determining the corrections proportionate to amplitudes, taking ratios and ascertaining angles, a special calculating rule requiring but two settings is installed at the top of the instrument column at the left.

After completing the first determination, the work is reversed in position and the correction determined for the plan initially over the pivots, thus completing the operation. As a critical speed of about 100 to 110 r.p.m. is said to give the best results, the machine can be manipulated by hand or by an electric motor suitably mounted. The speeds employed permit visual observation of the amplitudes, and prevent distortion of the work from centrifugal forces.

The machine is adapted to a wide variety of work, including balancing automotive crankshafts, flywheels, and parts readily mounted on arbors. It will receive bodies up to 24 in. in swing and 32 in. between bearings. The sensitiveness of measurement is said to be sufficient for bodies of small weight.

Giles 'Trip-Hammer" Staking Machine

The H. C. Giles Corporation, 303 Cox Bldg., Rochester, N. Y., has recently placed on the market the machine shown in the accompanying illustration for staking cupped or drilled rivets, studs, screws and other small screw-machine products. The machine is intended for mounting on a work bench or on a separate pedestal. It is actuated by the foot of the operator, a rod extending through the base to the treadle. An inclosed spring extending through the bench below the base of the machine serves to lift the treadle and spindle, while the springs on the side of the hammer provide an adjustment of the force of the blow. The spindle houses the hammer and the pad carrying the staking set. By a suitable mechanism, the bar at the top of the machine serving as a hammer is tripped when the staking set has been brought to position.



GILES STAKING MACHINE

It is said that work can be neatly and quickly riveted with the machine, and that uniformity of work results. Adjustments are provided for both the point of tripping and the height of lift of the hammer. The spring back of the pad in the spindle is ordinarily compressed about $\frac{1}{8}$ in. when the spindle is at its lowest point and the staking set is in contact with the work.

Stromberg Process-Timing and Signaling Instrument

An electrically operated timing and signaling instrument, intended for timing the length of a process, has been developed and placed on the market by the Stromberg Electric Co., Chicago, Ill. The instrument is for use in all manufacturing processes where the element of time is a factor, such as in the heat-treatment of steel, enameling, plating and etching. In this instrument the clockwork is eliminated, the mechanism consisting of an electric motor and gearing, which can be operated from an alternating-current circuit. The instrument will indicate the total length of a process, the length of time a process has been in operation, and how much longer the process is to continue; and then automatically operate the signal when the process is completed. The

STROMBERG PROCESS-TIMING INSTRUMENT

signal, which may be either a bell, a light, or both, will continue to operate until stopped by the person in charge.

One hand, shown on the right in the illustration and enameled red, is set to show the period of time of the process. The other or indicating hand starts from the point at which the instrument has been set and travels to zero. Thus the time that must elapse before the process is completed, is indicated. The button marked "change" is for setting the instrument for any length of process desired, causing the "setting hand" to move to the correct position.

When the indicating hand reaches zero and the signal is given that the process is completed, the operator pushes the button marked "set back," which causes the indicating hand to return quickly to the starting point. The indicating hand remains stationary at the starting point until the operator is ready to start a fresh process, at which time he presses the button marked "start," which releases the indicating hand and causes it to travel toward zero.

The white dial is 3½ in. in diameter and protected by a glass cover. The dials vary in markings and total time covered, depending upon whether they are to be used for long or short processes. The instrument can be furnished with any one of four standard dials. For an instrument which will operate a maximum time of 3 min. and 48 sec., the dial is graduated in seconds; for a maximum of 11 min. and 24 sec., graduations indicate three seconds; for 57 min., 30 sec.; and for 1 hr. and 54 min., the graduations are in minutes.

The electrical contact automatically made by the instrument at the end of the predetermined time may also be used for controlling current to operate mechanisms such as steam or air valves.

It is said that the instruments are very rugged and are built for hard service. The terminal box is conveniently arranged for the connecting of the wiring to signals and to the current supply. The instrument is 7 in. high, 5½ in. wide and 5½ in. deep, and weighs about 9 lb. It can be furnished to operate from 110- or 220-volt alternating current of any standard frequency.

Borgeson Universal Joint

A universal joint combining the features of ruggedness and adjustability has been placed on the market by the Borgeson Manufacturing Co., Torrington, Conn. The sockets of the joint are of cold-rolled steel milled from the solid bar, while the working parts are of carbonized and hardened mild steel.

BORGESON UNIVERSAL JOINT

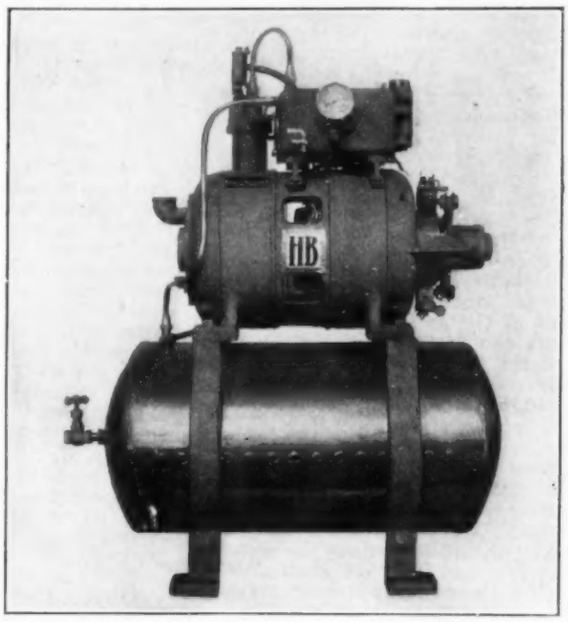
The "ball" is a cube with the corners rounded, and is made in two parts, held together by a bolt, nut and cotter pin. The pins upon which the ball swivels are driven into the wings of the sockets, and are staked in place. The bearing surfaces of the pins are tapered, and each pin has a small head or shoulder to preclude the possibility of its working loose.

To compensate for wear, the bolt is withdrawn and the flat mating surfaces of the two parts of the ball are ground slightly on a disk grinder, an operation quickly performed. Because of the tapered bearing surfaces of the pins, the joint will be tight when reassembled.

Hobart Automatic Air Compressor

The accompanying illustration shows an automatic air compressor unit recently placed on the market by the Hobart Bros. Co., Troy, Ohio. The device is especially intended for use in garages and service stations where it is necessary to keep a constant air pressure in the air lines. The maker claims that the device automatically does this, and that it requires no attention after once installed.

The device is compactly made, the compressor unit being mounted on top of the supply tank. The pump is of the rotary type and driven directly from the motor, which is mounted on the same shaft. The current is taken from the ordinary lighting or power circuit. No gears are employed and the shaft runs on ball bearings, so that the unit is quiet in operation.

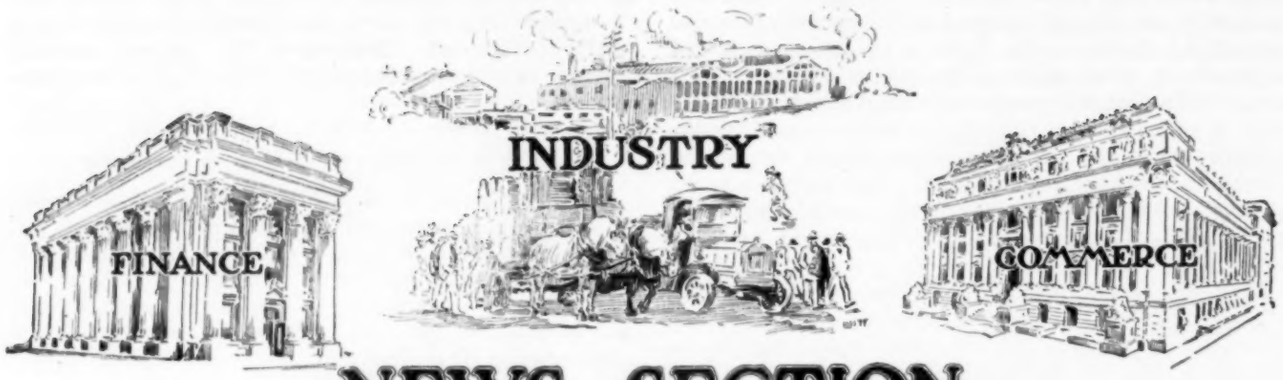


HOBART AUTOMATIC AIR COMPRESSOR

The chief feature to which the maker calls attention is the magnetic pressure release, which enables the motor to start without load. By this means instantaneous starting is assured, and the motor does not consume an unnecessarily large starting current. An air and oil filter, a safety valve, gage and tank are standard equipment, so that the unit is complete and ready for operation.

Pig Iron in Japan

The price of pig iron in Japan is below the cost of production, according to the *Far Eastern Review*, and stocks are estimated at 400,000 tons, of which 300,000 tons are held in Osaka, Kobe, Tokyo, and Yokohama, and 100,000 tons in Chosen and Manchuria. To stabilize prices a bank loan has been raised and a plan has been under consideration by manufacturers to provide for a uniform selling price through the operation of a syndicate.



NEWS SECTION

Briscoe Motors Sold to Earl Interests

Following a meeting of the board of directors held at Jackson, Mich., on Oct. 2, new plans for the Briscoe Motor corporation were announced whereby $5,000,000 additional capital will be put into the business immediately and the name of the factory organization will be changed to Earl Motors, Inc.

In making the announcement Clarance A. Earl, former first vice-president of the Willys-Overland Co., who took over control of Briscoe as president last March, stated that the board has voted unanimously for the introduction of the new capital, necessitated through the fact that the distribution end of the business has been expanded by the addition of 20 new distributors and 240 dealers in the past six months.

The plans also, according to Mr. Earl, involve the marketing nationally of a new "Earl" car, closed models of which will be ready for delivery Oct. 15 and open models Nov. 1. For the time being Briscoe cars are still being turned out, while certain divisions of the factory are busy on producing the parts for the new car soon to make its debut.

The board as now constituted with Mr. Earl as president consists of John John Fletcher, vice-president of the Fort Dearborn National Bank, Chicago, who is treasurer; H. F. Wardwell, president of the Burnside Tilden & Company, Chicago; Horace DeLisser, chairman of the Ajax Rubber Co., New York City; Wallace G. Kay, secretary and treasurer Kay & Co., Detroit; J. Fletcher Farrell, vice-president of the Sinclair Refining Co., New York; J. Weissenbach, of Weissenbach, Hartman, Crain & Cormack, Chicago, as directors and L. E. Latta as secretary.

Publicity Exhibit

The Third Annual International Sample Fair in Milan, to be held from April 12 to 17, 1922, will include a special section devoted to an exhibition of publicity methods. As planned at present, this exhibit will contain posters, catalogs, folders, pamphlets, and magazine advertisements, representative of as many countries as possible, and placed on exhibition without charge. The Italian Chamber of Commerce in New York City, 99 Hudson St., is assembling the exhibit to present publicity methods of the United States and is desirous of obtaining as much material as possible.

Prof. Cavalier at Columbia

Prof. Jacques Cavalier, rector at Toulouse, France, and a widely known authority on metallurgical chemistry, has come to America as the result of arrangements for an annual exchange of professors of engineering and applied science between French and American universities. This plan, which corresponds to the exchange of professorships in academic studies will be put into operation this fall.

Prof. Cavalier, who is now at Columbia University, New York City, and whose visit is another link in the world movement for engineering solidarity started by the organized engineers of American, England and France, will divide his time during the academic year among the co-operating institutions, Columbia, Harvard, Yale, Cornell, Johns Hopkins, Massachusetts Institute of Technology and the University of Pennsylvania. The American universities have selected as their representative in France for the first year Dr. A. E. Kennelly, professor of electrical engineering at Harvard and M. I. T.

Objects of S. A. E. Research Department

President Beecroft of the Society of Automotive Engineers, has expressed the view that within less than ten years the research department which the society has established recently will be of as great magnitude and value to the industry and the country as the renowned S. A. E. Standards Department which is just entering its second decade.

Dr. H. C. Dickinson, manager of the S. A. E. Research Department, in an address before the Detroit Section of the society at its opening session of this season, outlined the purposes, aims and possibilities of the department. He said that, in general, the testing of any individual device or any particular material is not included in the definition of research. On the other hand, the study of methods of test as well as the deduction of general information from a systematic series of tests is properly so classed, although to be of value as research the results must be put in such form that they can be of general application.

In general, the object of the S. A. E. Research Department is to secure through concerted effort more, and more reliable, fundamental technical information for the use of the members of the society and to make this information more easily available.

Dr. J. W. Richards, Noted Metallurgist, Dead

Dr. J. W. Richards, professor of Metallurgy at Lehigh University and world-wide authority on aluminum, died suddenly at his home in Bethlehem, Pa., on Oct. 12, of heart trouble. Dr. Richards was fifty-seven years old and was born in Oldbury, England.

Dr. Richards was one of the foremost engineers of the country and had an international reputation in various branches of metallurgical technology. His services were widely sought as legal expert in chemical and metallurgy cases. He was a member of many engineering clubs and the author of many books.

He was a charter member of the American Electro-Chemical Society, its first president in 1902, and 1903 and its secretary since 1907. He was a member of the Franklin Institute of Philadelphia, president of the chemical section, 1897-1899, and professor of electro-chemistry of the institute, 1907-1910.

He was a member of the American Institute of Mining and Metallurgical Engineers, former vice-president of the institute and chairman of the iron and steel committee since 1914; member of the Iron and Steel Institute of Great Britain and of the American Iron and Steel Institute. He was also a member of the Board of Engineering Foundation and a member of the National Research Council. He was representative of the American Institute of Mining and Metallurgical Engineers on the joint conference committee of the Federated American Engineering Societies.

Philadelphia Foundrymen Hear F. J. Ryan

The Philadelphia Foundrymen's Association held its 310th meeting in that city on the evening of Oct. 12. The subject of the lecture was "Recent Developments in Heating Coke Ovens with Oil or Electricity and the Heating of Iron, Brass and Steel in Electric and Oil Heating Furnaces." The speaker was F. J. Ryan, of F. J. Ryan & Co., Philadelphia. Mr. Ryan illustrated his remarks with a series of lantern slides and showed a recent installation of an electric coke oven in a Philadelphia foundry.

Following Mr. Ryan's talk a general discussion was held on the foundry industry—past, present and future. Thomas Devlin, president of the association, presided.

Delegates of American Engineering Societies Get French Honors

Nearly two hundred engineers attended the dinner to the delegation from the American Engineering Societies to Great Britain and France, at the Hotel Pennsylvania, on Monday evening, Oct. 10. Representatives of the British and French governments and of foreign engineering societies gave to the event an international aspect unique in gatherings of engineers. Medals struck by the French government were presented to the general chairman of the deputation, to the chairman of each individual delegation and to the presidents of the four founder societies. The meeting was regarded by engineers as formerly ushering in a definite movement for world unity in the engineering profession.

J. Vipond Davies, president of the United Engineering Society acted as toastmaster. The speakers were Ambrose Swasey, Charles F. Rand, F. B. Jewett, A. S. Dwight, John R. Freeman, all members of the deputation, and M. Gaston Liebert, French Consul General; Captain G. H. Armstrong, British Consul General; G. G. Clapperton, representing the British Institution of Electrical Engineers, and Prof. Jacques Cavalier, spokesman for the French universities. Among the engineers from other cities was Governor James Hartness, of Vermont.

Captain Armstrong, the first speaker, thanked the assembled engineers on behalf of His Majesty's government for the honor bestowed upon Sir Robert Hadfield, who with Eugene Schneider of Paris received the John Fritz Gold Medal at the hands of the deputation. The visit of the delegation had greatly furthered the movement for international co-operation among engineers, said Captain Armstrong, who made a strong plea for still closer relations between British and American engineering interests.

Mr. Davies in a glowing eulogy presented Ambrose Swasey, past president of the A. S. M. E. and sponsor of the Engineering Foundation, as the "dean of American engineers." Mr. Swasey, who was general chairman of the deputation, said that the French and British peoples are making giant strides in reconstruction and will speedily be back on a normal basis. "England will stand for hundreds of years as she has stood for hundreds of years in the past," added Mr. Swasey. "It is the same with France. We must help them, for their success is our success, and we are enshrined in their hearts."

France Will Pay

M. Liebert, the next speaker, asserted that French honor and industry would discharge the nation's debt to the last dollar. He spoke of the enormous resources of France, and declared that twenty years hence France would be on firm ground financially as one of the world's richest nations. At the close of a speech remarkable for its patriotic fervor, its optimism in its expression of international friendship, M. Liebert, on behalf of the French government, presented medals to the following:

George S. Webster, Philadelphia, president of the American Society of Civil Engineers; Edwin Ludlow, New York, president of the American Institute of Mining and Metallurgical Engineers; Edwin S. Carman, Cleveland, president of the American Society of Mechanical Engineers; W. McClellan, Philadelphia, president of the American Institute of Electrical Engineers; Charles T. Main, Boston, chairman of the A. S. C. E. delegation; A. S. Dwight, New York, chairman of the A. I. M. E. delegation; Ira N. Hollis, Worcester, Mass., chairman of the A. S. M. E. delegation; F. B. Jewett, New York, chairman of the A. I. E. E. delegation; Ambrose Swasey, Cleveland, general chairman of the deputation.

Herbert Hoover sent a message congratulating the deputation upon the success of its mission abroad and urging a closer union of engineering endeavor on both sides of the Atlantic. Cable messages were read from Sir Robert Hadfield, Eugene Schneider, the Institution of Civil Engineers, the Institution of Mining and Metallurgy and Mining Engineers, Captain Riall E. Sankey, president of the Institution of Mechanical Engineers; Magnus Mowett, secretary of the Institution of Mechanical Engineers; the British Iron and Steel Institute, Engineers Club of London, Faraday Society, Viscount James Bryce, Arthur Neal, member of Parliament from Sheffield; Jesse Merrick Smith, and A. E. Kennelly, exchange professor to France.

Honors conferred upon the visiting American engineers was cited as fresh evidence of the permanence of the ties of friendship and interest created during the war. Mr. Swasey was elected to honorary membership in Institution of Mechanical Engineers, the Institution of Mining and Metallurgy and the Institution of Mining Engineers. He also received the Cross of the Legion of Honor and was made an honorary member of the Societe des Ingenieurs Civils de France.

Mr. Rand was elected to honorary membership in the Iron and Steel Institute, Institution of Mining and Metallurgy and the Institution of Mining Engineers. Arthur S. Dwight and William Kelly were elected to honorary membership in the Institution of Mining Engineers.

The members of the deputation, in whose honor the dinner was given, were as follows: Ambrose Swasey, general chairman and member of delegation from A. S. M. E.; Charles T. Main, chairman of delegation from A. S. C. E.; John R. Freeman, member of delegation from A. S. C. E.; Robert A. Cummings, member of delegation from A. S. C. E.; Lieut-Colonel Arthur S. Wwight, vice-chairman and member of delegation from A. I. M. E.; Charles F. Rand, secretary and member of delegation from A. I. M. E.; William Kelly, member of delegation from A. I. M. E.; Ira N. Hollis, chairman of delegation from A. S. M. E.; Jesse Merrick Smith, member of delegation from A. S. M. E.; Lieut.-Colonel Frank B. Jewett, chairman of delegation from A. I. E. E.; Arthur E. Kennelly, member of delegation from A. I. E. E.; Major-General George O. Squier, member of delegation from A. I. E. E.

American Gear Manufacturers' Association at Rochester

The semi-annual meeting of the American Gear Manufacturers' Association was held in Rochester, N. Y., at the Powers Hotel on October 13, 14 and 15, and was well attended. As usual with this association, there was not an idle moment, the main features of the meeting being the reports of committees on the many factors of gear making subject to standardization.

The convention was welcomed to Rochester by Andrew C. Gleason, and the Gleasons, individually and collectively, did much to make the meeting a pleasing and lasting memory to those who were fortunate enough to attend. Some idea of the scope of the reports may be had from the following list of committees and their chairmen: "Public Policy," H. E. Eberhardt, "Legal," J. E. Gleason; "Publicity," J. C. McQuiston; "Uniform Cost Accounting," J. H. Dunn; "Industrial Relations," J. B. Foote; "Tariff," S. L. Nicholson; "General Standardization," B. F. Waterman. Under this latter heading came sub-committees on "Spur Gears," Frank E. Eberhardt; "Bevel and Spiral Bevel Gears," F. E. McMullen; "Gears and Pinions, Electric Railway and Mine," W. H. Phillips; "Nomenclature," Frank E. Eberhardt; "Worms, Worm Gears and Spirals," J. C. O'Brien; "Inspection," F. G. Eppley; "Sprockets," C. R. Weiss; "Metallurgical," C. B. Hamilton Jr.; "Composition Gearing," John Christensen; "Keyways," H. J. Eberhardt; "Herringbone Gears," A. F. Cooke; "Differentials," S. O. White; "Transmissions," A. W. Copland; "Tooth Form," H. J. Eberhardt; "Library Committee," E. W. Baxter.

In addition to the reports of committees there were addresses on "Gear Tooth Wear," by S. O. White, chief engineer of the Warner Gear Co.; "First Hand Impressions of Europe," by E. S. Sawtelle, assistant general manager of the Tool Steel Gear and Pinion Co.; "Duralumin as a Material for Worm and Other Gearing," by R. W. Daniels, Baush Machine Tool Co., and an excellent paper on "Tooth Forms," by E. W. Miller, chief engineer of the Fellows Gear Shaper Co.

As a respite from the almost continuous night and day sessions, the convention visited the Gleason Works on Friday, the 14th, in time to partake of an excellent lunch in their splendid cafeteria. After lunch a brief session was held at which bevel gear tooth forms were discussed by many members. The subject was, however, postponed to a later date so that sufficient time could be devoted to the proper consideration of the standard proposed. Following this was an inspection of the Gleason plant, with particular attention to several recently completed machines.

The machines shown were a three-spindle bevel gear rougher, a three-spindle bevel gear generator, which finishes both sides of a tooth space at once, and an 8-in. spiral bevel gear generator, a 4-in. spiral bevel gear generator, a two-tool 38-in. bevel gear planer, in which the toolblocks can be reversed so as to cut either forward or backward, a 9-in. bevel gear generator, and a new burnishing machine for burnishing the teeth of bevel pinions. Then there was a chamfering machine for trimming the outer ends of spiral bevels, special cutter grinders for spiral bevel cutter heads, and a continuous electrically heated furnace for the hardening of gears. This is built for a temperature of 1,550 deg. F. and the rate of feed of the work through the furnace can be timed to suit.

The informal banquet was well attended and was followed by dancing. Both the speakers were well received and left a message for after consideration. Ernest A. Paviour, formerly president of the Rochester Advertising Club, after some clever sallies which included "Phillie Gear" Markland, spoke strongly of the value of the trade or business papers for advertising mechanical products as against the use of general magazines for this purpose.

Hon. Arthur E. Sutherland, ex-judge of the Supreme Court, spoke on "Capital and Labor." After pointing out the shortcomings of some of the labor leaders he said that employers must recognize skill and ability on the part of the workers more than they have done in the past. He said, "The moment a worker gains ability or skill to make an article better than it ever has been made before he gains capital; a capital that cannot be bought or sold and that the sheriff cannot attach. When we discuss capital and labor we sometimes forget that it is ability which has made the world progress. Ability is a capital contribution and must be accorded its proper place, whether it is contributed as an industrial worker or in a managerial role. This ability must be recognized and he who gives it must be allowed a return or dividend on the investment. The worker who, day after day for a term of years, gives ability, skill and precision to his work has a right to expect something more than just a pay envelope on pay day. He has an equity in the business he has helped to build up, and the employer who believes in and practices the square deal, will recognize this equity."

After a strenuous morning, the last session running until almost 2 p.m. on Saturday, the Gleasons provided automobiles and took the whole party to the White Horse Tavern, about 23 miles out of Rochester, to a clam bake which will long be remembered. Games for both the men and the ladies whetted the appetites for dinner, and no clams, lobsters or chickens were ever enjoyed by a more enthusiastic gathering. Any member or guest who can forget the Rochester meeting is a fit subject for a course in memory training,—or worse.

The President's Conference on Unemployment

General Recommendations for Measures for Permanent Recovery of Employment

Recovery of our industry and employment must necessarily be a process of gradual healing of the great economic wounds of the World War. This healing is making distinct progress.

Without attempting the impossible task of assessing the relative weight of different forces, the conference presents the following summary of the more important matters that require constructive and immediate settlement if recovery in business and permanent employment are to be more expeditiously accomplished:

(1) Readjustment of railway rates to a fairer basis of the relative value of commodities, with special consideration of the rates upon primary commodities, at the same time safeguarding the financial stability of the railways.

(2) Speedy completion of the tax bill with its contemplated reduction of taxes, in order that business now held back pending definite determination may proceed.

(3) Definite settlement of tariff legislation in order that business may determine its future conduct and policies.

(4) Settlement of the financial relationships between the Government and the railways, having in mind the immediate necessity for increased maintenance and betterments, making effective increased railway employment and stimulation of general employment in order that the railways may be prepared for enlarged business as it comes.

(5) Limitation of world armament and consequent increase of tranquillity and further decrease of the tax burden, not only of the United States but of other countries.

(6) Steps looking to the minimizing of fluctuations in exchange, because recovery from the great slump in exports (due to the economic situation in Europe) can not make substantial progress so long as extravagant daily fluctuations continue in foreign exchange, for no merchant can determine the delivery cost of an international shipment.

(7) Definite programs of action that will lead to elimination of waste and more regular employment in seasonal and intermittent industries, notably in the coal industry, in order that the drain upon capital may be lessened and the annual income of workers may be increased.

(8) In the field of all the different industries and occupations the rapidity of recovery will depend greatly upon the speed of proportionate adjustment of the inequalities in deflation. A table is attached hereto, drawn from various sources, showing the percentage of present levels above the levels of the same commodities and services of the pre-war period. It will be observed that agriculture has reached an unduly low plane, while transportation, coal, and some branches of the construction industries are of the highest. It will also be observed that there is an entire disproportion between the price of the primary commodities and the ultimate retail price. These disproportionate increases in the progressive stages of distribution are due to increased costs of transportation, enlarged profits, interest, taxes, labor, and other charges.

If the buying power of the different elements of the community is to be restored, then these levels must reach nearer a relative plane. For example, the farmer can not resume his full consuming power and thus give increased employment to the other industries until either his prices increase or until more of the other products and services come into fair balance with his commodities, and therefore within reach of his income.

APPROXIMATE INDEX NUMBERS, BASED UPON 100, FOR 1913

	August, 1921.
Cost of living:	
Department of Labor (May survey)	180
National Industrial Conference Board	165
Average price to producer, farm crops	109
Average price to producer, live stock	113
Average wholesale price, foods	152
Average retail price, foods	155
Wheat and flour:	
Wheat average to producer	128
Flour, wholesale, U. S. average	173
Bread, retail, U. S. average	173
Freight rate flour, Minneapolis to New York domestic	187
Live stock and meats:	
Pork—	
Hogs to producer	116
Wholesale ham at Chicago	166
Retail ham	197
Wholesale bacon, rough side	102
Retail sliced bacon	162
Wholesale short side	108
Wholesale pork chops	184
Retail pork chops	181
Retail lard	115
Beef—	
Cattle, average to producer	91
Wholesale carcass beef at Chicago	124
Retail, sirloin steak	157
Retail, round	160
Retail, rib roast	147
Retail, chuck roast	130
Retail, plate beef	112
Wages in meat packing (Department of Labor investigation)	186
Freight rates, dressed beef, Chicago to New York	214
Hides and leathers:	
Hides, green salted, packers, heavy native steers (Chicago)	76
Hides, calfskin, No. 1, country, 8 to 15 lb. (Chicago)	86
Leather, sole, hemlock, middle No. 1 (Boston)	120
Leather, chrome, calf, dull or bright, "B" grades (Boston)	195
Wholesale boot and shoes, men's vici calf, blucher-Campella (Brockton)	225
Freight rate shoes, Lynn, Mass., to Chicago	210
Wage scales in shoe industry (Massachusetts), about	200
Cotton:	
To producer	105
Yarns, carded, white, Northern mule, sun, 22 cones (Boston)	107
Wholesale sheeting, brown 4/4 ware, shoals L. L. (N. Y.)	118
Wholesale printcloth 27 in., 64 x 60, 7.60 yd. to pound (Boston)	137
Wool:	
To producer	92
Wholesale worsted yarns 2/32, crossbed stock white in skein (Philadelphia)	148
Wholesale women's dress goods, storm serge, all wool, double warp, 50 in. (N. Y.)	157
Wholesale suitings, wool-dyed blue, 55-56, 16 oz., Middlesex (Boston)	183
Freight rate clothing, New York to Chicago	210
Wage scale in mills, about	200
Building and construction:	
Prices—	
Lumber, average southern pine and Douglas fir (at the mill)	128
Brick, average common, New York and Chicago	199
Cement, Portland, net, without bags to trade, f.o.b. plank (Buffington, Ind.)	175
Freight rates—	
Brick, common, Brazil, Ind., to Cleveland, Ohio	204
Cement, Universal, Pa., to New York	179
Building labor:	
Union scale, simple average, 15 occupations	190
Union scale, weighted average, 8 occupations, frame houses (3)	197
Union scale, weighted average, 8 occupations, brick houses (3)	193
Common labor	130
Construction costs: Cement buildings (Aberthaw Const. Co.)	161
Coal:	
Price, bituminous, Pittsburgh	186
Price, anthracite, New York Tidewater	198
Union wage scales, about	173
Non-union scale, about	136
Freight rates	187-299
Metal trades, union wage scale: Simple average, 19 occupations	218
Metals:	
Prices—	
Pig iron, foundry No. 2 Northern (Pittsburgh)	137
Pig iron, Bessemer	128
Steel billets, Bessemer (Pittsburgh)	115
Copper, ingots electrolytic, early delivery, N. Y.	75
Lead, pig, desilverized, for early delivery, N. Y.	100
Zinc, pig (spelter), Western, early delivery, N. Y.	80
Day labor, scale U. S. Steel Corporation	150
Printing and publishing:	
Book and job, union wage scale	194
Newspaper, union wage scale	167
Railroad, average receipts per ton-mile	177
Bureau Railway Economies estimate of railway wages, based on average annual compensation, third quarter	226
General estimate all union wage scales by Prof. Wolman	189

Note.—The wage indexes refer mostly to wage scales, not the earnings which necessarily also depend upon regularity of employment.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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In these letters I have more than once alluded to the economic importance of the coming Disarmament Congress, and the increased confidence likely to follow an agreement that would reduce the burden of the world's taxation and expenditure for military preparedness. But the high hopes thus inspired have been dashed by the action of the Senate last Monday in passing the bill which repudiates the Hay-Pauncefoote treaty and exempts coastwise American shipping from the payment of Panama Canal tolls.

For this the Democrats are as much to blame as the Republicans, for the bill could not have been passed if some Democrats had not voted for it, and while the opposition of the President and Senator Lodge may make the Senate action a legal nullity, it is generally felt that the willingness of our most important legislative body to disregard our treaty obligations renders it very unlikely that the foreign powers will be disposed to take our disarmament proposals seriously.

To this feeling the reactionary tendency of the financial markets last week would seem to be directly due. The decline in Liberty Bonds was the first and an entirely logical expression of a lessened confidence in the future. An undiminished expenditure for war means more bonds and more bonds mean lower prices for those already issued. The total of Liberty Bonds and Victory Notes outstanding Oct. 1 was $18,938,199,050.

The advance from the record low prices of 1920 to the high prices of Saturday, Oct. 8, was equal to an appreciation of $1,712,400,000 in the value of these securities. The decline in the four most active issues that has occurred since Oct. 8, the last market day preceding the action of the Senate, averages 56 points, which is equal to nearly $100,000,000 on the amount outstanding.

These figures will give a partial idea of what the game of politics as at present played is costing this nation, but they represent only a fraction of the loss due to the partial paralysis of enterprise that is being caused by Congressional ineptitude and delay. President Harding is doing his best but unless public sentiment can be aroused and crystallized in his support there will be a strangulation instead of a revival of business.

Therefore I take advantage of a comparatively newsless week to urge all the men of affairs who read these lines to write to their Senators and Representatives at once urging prompt and rational action upon the financial questions before Congress, especially those which have to do with taxes and the tariff. Almost anything would be better than the present uncertainty, which to my personal knowledge is holding up new enterprises that would put over fifty million dollars in constructive circulation.

After the news from Washington and the sensational fluctuations in the price of Liberty Bonds, probably the most important item in the week's record is the foreign trade statement for the month of September.

Net imports of gold during September, 1921, were $62,000,000. Even allowing for the decline in prices these figures show somewhat greater decrease in exports than had been expected but the balance of trade in our favor is surprisingly large when it is considered that we are practically exacting payment of it in gold.

A surprising development of the week is that for the first time since the present tide of gold turned toward this country the amount of the metal held by the Federal Reserve Banks shows a decrease. The drop totals only $4,000,000 and possibly results from use of gold in paying off obligations due to the member banks. If this assumption is correct the decrease is only a species of statistical camouflage without barometric significance. It does not change my view that a period of steadily easing credit and stimulated industrial activity lies ahead of us, and though the softness of stocks, grain and cotton seems a challenge to my opinion, the unwillingness of the public to buy in the speculative markets is only a natural result of the feeling that Congress may put more sand in the driving mechanism of the business locomotive—than it pours on the rails.

Not in weeks have the barometric indications in the news been so uniformly favorable. The unfilled tonnage of the United States Steel Corporation on Sept. 30 showed an increase for the first time since July, 1920. September automobile shipments showed less than last year's seasonal decline. Building last month was more active than in any previous September on record, and lumber orders for the last week of the month exceeded the first week by 65,000,000 feet. Coal production steadily increases. The Bureau of Labor Statistics reports a slight gain in the number of workers employed during the month. And the Treasury statement of Oct. 1 shows a gain in the money circulation per capita from $52.41 to $52.45, which, while too small to be important, is significant because it is the first break in the decline which has been going on for nearly a year.

Copper at 13 cents is 1⅛ cents above the August quotation and sales are far ahead of production. Advances in crude and refined oil prices have followed rapidly on the general and apparently sudden perception that demand on its return to normal will meet a curtailed supply. This rapid upturn is comparable to the sharp advance which occurred in cotton last month and it is having the same stimulating effects on trade in the regions affected. A similar recovery is to be expected eventually in coffee and sugar, though they declined last week, for a period of excessively low quotations for the great staples is invariably followed by a curtailment in production and an advance in price. Already Cuban reports indicate a marked decrease in the sugar crop for 1922.

Demand for lower railway rates from many important quarters, including the agricultural "bloc" in the Senate and the unemployment conference, will strike a common target at the meeting of railway executives now being held in Chicago. A statement by President Rea, of the Pennsylvania, that lower rates are necessary to readjustment connotes an important change from the attitude heretofore held by many executives that the increase last year was so small as to play no part in curtailing traffic. A voluntary rate reduction would place the powerful weapon of public support in the railroads' hands for use in their war against present wage scales and working rules.

Not the least important item of the week is a confirmation of reports that women's skirts are to be longer, which government statisticians estimate will mean the consumption of $50,000,000 worth of cloth above last season's total.

From abroad comes news of another billion mark expansion in German note circulation and a continued scramble in central Europe to exchange paper money for physical property, which can only presage an uninterrupted decline in the purchasing power and ultimate demonetization of the irredeemible paper in circulation. Reflecting this the mark has declined to a new low, and in New York last Thursday 100 marks could be bought for 69 cents.

The threat which this plague spot holds for the rest of the world is not yet adequately understood here. American relief workers in Russia report that the suffering from famine is far worse than they have seen in any other European country. I know my readers will be surprised to learn that there are three wars at present being fought across the atlantic, the Greco-Turkish, the Spanish-Moroccan, the Albanian-Jugo-Slavian, and that fighting is going on in Silesia and Burgenland, between Austria and Hungary. Western Europe, however, makes progress, and sterling exchange advanced to $386⅛ last week. In India Gandhi's "passive non-co-operation" has become active enough to burn European goods and the movement, with its potentialities of more serious trouble, is gathering strength.

Only infrequent shadows of these troubles falls across the United States, and certainly none of them have darkened the Polo Grounds in New York where 270,000 people have paid nearly a million dollars to see eight baseball games. That this should go on while a conference in Washington was discussing means to relieve unemployment is a spectacle worthy of the attention of any able satirist. Discussion of the incongruity is not within the scope of these articles, but it is obvious that nothing can be seriously wrong with a country where thousands of important business men can shed their troubles so lightly.

Industrial Engineers in Convention at Springfield

"Industrial Stability" the Keynote—Delegates Visit Local Factories —Professor Roe Elected President

The Society of Industrial Engineers held its national fall convention in the Municipal Auditorium in Springfield, Mass., Oct. 5, 6 and 7, with about 600 delegates in attendance. The meetings dealt with the topic of "Industrial Stability." In addition to the main gatherings there were sectional meetings for groups having to do with the respective departments of education, manufacturing and selling, financing and accounting and industrial relations. Inspection trips were made by the groups to the principal manufacturing plants of Springfield and vicinity.

President L. W. Wallace, of Washington, D. C., opened the convention Wednesday afternoon with an address In which he assigned as the chief causes of industrial unsettlement the fluctuation in the purchasing power of the dollar, over-expansion of currency and credit, excessive taxation, short-sighted labor policies and various forms of waste in production. He was followed by F. M. Feiker, assistant to Secretary of Commerce Hoover, who spoke of the need of a government service that would provide a barometer of business analogous to the Weather Bureau, and also of the need of better research facilities enabling a business man to possess the facts in relation to his line of business at any given time. A start had been made along this line, he said, by the Commerce Department. He spoke of the need of further localization of statistics as a factor in stabilization.

At the Wednesday evening meeting the principal address was by E. St. Elmo Lewis, of New York, on "Setting Sales Standards." He considered the subject as related to quotas for the individual and incentives to the salesman. He said the present situation has come to a point where every one must take his losses and assist in bringing about the economic balance. "At this time," he said, "we find the manufacturer getting his raw materials at a much lower cost than formerly, but labor costs have dropped but little. Accordingly, the laboring man faces two alternatives. Either he must produce more in return for the wages he receives, or he must perform the same amount of work for lower pay. But labor is not the only one that must submit to a readjustment. Railroad rates must be reduced and taxation equalized."

At the Thursday evening meeting president Ira N. Hollis, of Worcester Polytechnic Institute, presided and made a short address in which he expressed the belief that future stability depended on the relations of factory owners, managements and employees being harmonized. Arthur T. Davenport, of Sweet, Orr & Co., New York, spoke on "The Importance to the Factory of Constant Output." Harry Arthur Hopf, organization counsel for the Federal Reserve Bank of New York, spoke on "Standardization of Salaries of Administrative Employes," accompanying his remarks with stereoptican slides. He stressed the point that a standardized wage system not only made for fairness to employees and afforded a better incentive to work, but it enabled the employer to know better what his business is costing.

A luncheon meeting was held Friday noon at the Hotel Kimball under the direction of the committee on elimination of unnecessary fatigue in industry. Frank B. Gilbreth, of Montclair, N. J.; urged the use of white paint for office and factory interiors, to the end of eliminating color fatigue and giving added keenness of vision.

Friday afternoon's meeting dealt with "The Elimination of Waste in Industry by Standardization." Robert B. Wolf, of New York, dealt with material standardization; and Frank B. Gilbreth, of Montclair, N. J., with "Standardization of the Task.." General discussions ensued on each topic.

The convention was concluded Friday night with a banquet at the Hotel Kimball, with L. W. Wallace as toastmaster. Reuben A. Lundquist, chief of the electrical division of the Federal Department of Commerce, spoke on "The Influence of Foreign Trade on Industrial Stability," showing the close interrelationship of American and Europe in the matter of necessary readjustments. Floyd Parsons, of Philadelphia, spoke on "The Education of the Public for Industrial Stability." He referred to the unequal advance of civilization as regards science, industry, business and politics and said we must learn to apply the same scientific spirit in respect to production and distribution that was manifest in the scientific and technical fields. He pointed out glaring defects in our social order that make for instability.

Every morning was devoted to excursions to nearby industrial establishments, during which many instructive points relative to factory management, cost accounting, and so on, were elicited. The plants visited were: National Equipment Co., candy machinery, Springfield; American Bosch Magneto Co., Springfield; Gilbert & Barker Manufacturing Co., gasoline pumps and tanks, Springfield; William Carter Co., underwear, Springfield; Greenfield Tap & Die Corporation, Greenfield; McCallum Hosiery Co.; Northampton; Fisk Rubber Co., Automobile tires, Chicopee Falls; Rolls-Royce of America, Inc., Automobiles, Springfield; Chemical Paper Manufacturing Co., Holyoke; Hendee Manufacturing Co., motorcycles and bicycles, Springfield; Strathmore Paper Co., Mittineague, and Moore Drop Forging Co., Springfield.

Speakers who bore a prominent part in the sectional conferences were W. G. Sheehan, Detroit; A. L. Rose, Cumberland, Md.; Joseph W. Roe, New York; Robert Douglas, Boston; Ralph Barstow, Greenfield, Mass.; Matthew Porosky, Boston; Horace G. Crockett, New York; Dudley R. Kennedy, New York; George E. Buxton, Pottsdam, Pa.; B. M. Maynard, New York; Gordon Wilson, New York, and Clinton H. Scovell, Boston.

Officers of the society for 1922 were chosen as follows: President, Joseph W. Roe, head of the industrial engineering department of New York University; treasurer, F. C. Schwedtman, vice-president National City Bank, New York; secretary, W. G. Sheehan, Detroit: business manager, George C. Dent, Chicago.

Business Items

The Wilmarth & Morman Co., of Grand Rapids, Mich., manufacturers of grinding machinery, have issued revised catalogs as of Oct. 1, announcing reductions in price varying with different machines but amounting in some cases to 16 per cent.

The Austin Machinery Corporation, of Chicago, has organized a subsidiary firm at Woodstock, Ontario, Canada. The concern has been incorporated under the laws of Canada and will act as sole manufacturer and distributor of a complete line of Austin earth-moving and concrete-mixing equipment.

Notice has been received of the formation of a partnership to be known as Sir Charles Bright & Partners, with offices at 146 Bishopgate, E. C. 2, London, England. Sir Charles Bright, senior member, is a well-known British consulting engineer; A. T. Stubbs was formerly engineer in chief of the royal post offices; Lt.-Col. H. W. Woodall has been a consulting engineer with several large gas and motor companies; A. Hugh Seabrook has been identified with engineering service for 20 years, specializing in electric and railroad enterprises.

Mayor James E. Higgins, of Chicopee, Mass., who has owned and operated the Higgins & Co. brass foundry at Holyoke, Mass., for the last 23 years, has retired and sold his interest in the business to his partner Frank Williams, who will run the business as in the past.

The Toronto, Ontario, Canada, office of the Independent Pneumatic Tool Co., Chicago, Ill., has been removed from 32 Front St. West, to No. 163 Dufferin Street, Toronto. This new location will give the company larger space and increased facilities for carrying a complete stock of Thor pneumatic tools, electric tools, spare parts and accessories. The Toronto office will remain in charge of William McCrae.

The East Iron and Machine Co., at Lima, Ohio, employing a large number of men, has sufficient orders on hand for machinery to keep the plant on full time until Jan. 1, according to sales manager A. J. Filliez.

Part-time classes for apprentice machinists have been initiated by the United Foundry and Machine Co., Youngstown, Ohio, the first industrial concern to take advantage of this privilege for its apprentices under the new Smith-Hughes school law. R. W. Hiestand, experienced trade and industrial teacher, of Dayton, is in charge of the classes, which are held three days a week.

The Hartford Tap and Gauge Co., of Hartford, the Hanson-Whitney Machine Co., Inc., the Taylor & Fenn Co. and the Whitney Manufacturing Co., have arranged to be represented in New York by L. C. Bigelow & Co., Inc.

The Cumberland Foundry and Supply Co., Cumberland, Md., has leased the foundry of the Union Mining Co., Mt. Savage, Md. The making of aluminum patterns will be a feature of the new unit.

Personals

EDWARD KOPPER, JR., formerly assistant superintendent of the American Hoist and Derrick Co., St. Paul, Minn. has severed his connection with that concern to become associated as a partner in the H. C. McNair Co. also of St. Paul, agents for manufacturers' of steel and railway supplies.

RAYMOND P. FRYE has resigned his position as chief draftsman of Page, Beck & White, Inc., Chicago and is now with the Western Electric Co. as special machine designer.

E. O. ZACHARIAS has accepted a position as assistant chief engineer with The Shanklin Manufacturing Co., Springfield, Ill. He was formerly master mechanic for the Teavous Spring Lubricator Co., Cleveland, Ohio.

H. A. BRINKERHOFF and R. W. STOVEL, for many years associated with Westinghouse, Church, Kerr & Co., and since 1920 with its successor, Dwight P. Robinson & Co., Inc., announce the formation of a partnership as engineers and contractors, with offices in New York City.

J. M. WILLIS, formerly vice-president and general manager of the Baltimore Dry Docks and Shipbuilding Co., Baltimore, Md., has been appointed general manager of the Baltimore Dry Docks Plant of the Bethlehem Shipbuilding Corporation. He will also have charge of all ship repair sales in the Baltimore district. The Baltimore Dry Docks Plant of the Bethlehem Shipbuilding Corporation was formerly the Baltimore Dry Docks and Shipbuilding Co., having recently been acquired by the Bethlehem interests.

GEORGE H. HARTMAN, mechanical engineer of the Locomotive Appliance Co., Toledo, Ohio, has accepted temporarily the position of mechanical engineer for the Autovent Co. and the Service Machine Co., both of Cleveland, Ohio.

ARTHUR E. HUTCHINSON, who is associated with the Grinnell Co. has been transferred from Warren, Ohio, to New York City.

E. J. LORING is now chief engineer, Aircraft Armament Division, Ordinance Dept., U. S. A. and is located in Washington, D. C.

F. F. BOYD, formerly vice-president and manager of the Providence Engineering Corporation, New York City, is now connected with the Ames Iron Works, of that city.

PROF. COMFORT A. ADAMS has resigned as chairman of the Division of Engineering of the National Research Council and is devoting his time to his work at Harvard Engineering School, Cambridge, Mass. Alfred D. Flinn has assumed temporary chairmanship of the division.

ROBERT L. BROWNE, of the Metal and Thermit Corporation, has been transferred from New York City to Boston.

WILLIAM A. MILLER has severed his connection as mechanical draftsman and tool designer for the U. S. Hame Co., Buffalo, N. Y., and is now serving in a similar capacity for the J. P. Devine Co. of that city.

FRED C. SCHREIBER, formerly with Stocker-Rumely-Wachs & Co., Chicago, Ill., is now with the Sterling Grinding Wheel Co.

JAMES E. FRITZ is leaving the Stocker-Rumely-Wachs Co., Chicago, Ill., after seventeen years' connection. He has not announced his plans as yet.

C. B. COLE has opened an office at 546 West Washington St., Chicago, Ill. as consulting mechanical engineer. He is specializing in tools, gages, systems and interchangeable manufacturing.

J. W. WALL, formerly with the Gardner Governor Co., Chicago, Ill., is now general manager of the U. S. Lock Nut Corporation.

GUS V. ZIV, formerly manager of the Chicago branch of A. Milne & Co., announces his entry into business for himself as president and treasurer of the Ziv Steel and Wire Co., 4423 West Kenzie St. The new company will handle tool and solid drill and hollow drill steel. Norman J. Hyslip is general sales manager.

RICHARD H. COLLINS, formerly vice-president and director of the General Motors Corporation and president and general manager of the Cadillac Motor Car Co., has assumed active management of the Peerless Truck and Motor Corporation of Cleveland, Ohio. It is reported that Mr. Collins acted individually in putting over this $4,500,000 deal. A general reorganization of the Peerless company will take place.

PETER D. THROPP, treasurer of the John E. Thropp Sons' Co., Trenton, N. J., recently underwent a serious operation at the Atlantic City (N. J.) Hospital. He was on his way to that city to join his family when he was taken ill on a train.

W. B. MONTGOMERY, previously staff service director of C. E. Knoeppel & Co., Inc., industrial engineers of New York City, is now located in Rochester, N. Y., with A. F. Stock, formerly of the same company, under the firm name of Montgomery & Stock, industrial engineers.

H. W. TOWNSEND, formerly district manager of the Aldrich Pump Co., Pittsburgh, Pa., office, has returned to the main plant in Allentown, Pa. as works manager.

RUSSELL G. PADDOCK has resigned his position as tool designer and engineer with the Indiana Lamp Co. of Connersville, Ind., and has accepted an instructorship in the School of Mechanical Engineering at Purdue University.

AUGUST ULMAN, JR. is now instuctor in mechanical engineering department at the University of Pennsylvania. He was formerly connected with the General Chemical Co., Marcus Hook, Pa.

J. W. MCMORRIS has accepted a position with the Mercer Motors Company of Trenton, N. J., as factory manager.

NORMAN ALLDERDICE, superintendent of the open hearth department of the National Tube Co. plant at Lorain, Ohio, and son of Taylor Allderdice, vice-president of the National Tube Co., has been made sales manager in the Cleveland and Pittsburgh districts, with offices in Pittsburgh. He succeeds the late Robert A. Boyle, vice-president of the company and manager for that district. H. J. Hair, office manager at Pittsburgh, has been appointed district sales manager in Pittsburgh.

H. W. BISHOP, JR., formerly in the general sales department of the La Belle Iron works, Steubenville, Ohio, has been made sales manager of the Superior Pipe Co., Columbia, Pa.

Obituary

HENRY B. BARNETT, superintendent of the open hearth department, Brier Steel Company is dead at his home in Youngstown, Ohio. For the past five years he had been identified with that company, coming there from Chicago where he had been superintendent of the Illinois Steel Co. for eight years. He was 59 years old.

ALBRO M. TILTON, founder and president of the Drop Forging Co., of New York, died suddenly on Oct. 5, at his home in Brooklyn, N. Y. He was 55 years old.

WILLIAM B. BUTTERWORTH, director of the H. W. Butterworth & Sons Co., Philadelphia, Pa., died on Oct. 5. He was a prominent manufacturer of textile machinery.

Trade Catalogs

Polyphase Induction Motors. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin No. 1118 describing a new line of continuous rated polyphase induction motors, covering in particular the type "AR" squirrel cage line. The type "B" potential starter is also introduced.

Deep Hole Drilling Machines. Pratt & Whitney Co., Hartford, Conn. Circular No. 273 illustrating and describing a recently perfected line of deep hole drilling machines.

Catalogs Wanted

The Klamath Iron and Steel Works, Inc., Klamath Falls, Oregon, would be pleased to receive catalogs of machinery and equipment to replace those destroyed when fire razed its plant on Sept. 9.

C. H. Connell, Box 5, Aurora, Mo., would like to receive catalogs on all kinds of machinery and equipment for car and railroad shops, garages, foundry, mill and general factory buildings.

A concern in Southern California is desirous of receiving catalogs on machinery for manufacturing pistons (not over 6 in.) and piston rings. Address all communications to S. Hoffman, 415 West Fifth St., Santa Ana, Cal.

A prominent Argentine engineering magazine which provides a free service for any of its subscribers who may desire information on where to purchase construction materials, machinery, etc., would be glad to receive catalogs from American manufacturers of building materials, construction machinery, and railway equipment. These will be placed at the disposal of the subscribers, who number nearly 7,000. The name of the periodical may be obtained from the Bureau of Foreign and Domestic Commerce or its district or co-operative offices by referring to file No. 47120.

Forthcoming Meetings

The annual convention of the Industrial Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

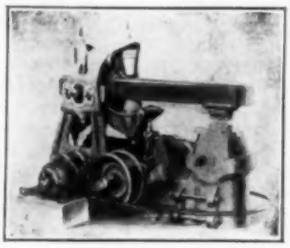
The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

The twenty-fifth annual convention of the National Founders' Association will be held in the Hotel Astor, New York City, on Nov. 16 and 17.

Condensed-Clipping Index of Equipment

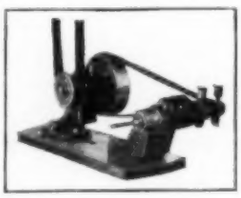
Patented Aug. 20, 1918

Hammers, Power, Helve, Motor Drive for
C. C. Bradley & Son, Inc., Syracuse, N. Y.
"American Machinist," June 9, 1921



The hammers built by the concern can now be furnished with electric motor drives. The drives are not direct, but through belts. The cushioned helve hammer shown has the motor on a separate foundation at the side of the machine, which arrangement can be applied to the other types, so as to have the motor on a mounting separate from the machine. The application of motors and belts is clearly shown. Motors for alternating or direct current and with various voltages, phases and cycles can be furnished.

Attachment, Grinding, Internal
Hjorth Lathe and Tool Co., 27 School St., Boston, Mass.
"American Machinist," June 9, 1921



It is said that the attachment can be used on practically any of the plain or universal grinding machines now on the market. It has a ceiling countershaft adjustment and a table center adjustment of 2½ in. for accommodating different center heights, and also its own countershaft belt adjustment between the quill bracket and countershaft. The spindles are of two types, one for deep and large holes and one with taper arbors for small holes. Each spindle has two adjustable bearings, lubricated by oil chambers, and a separate adjustable end thrust bearing. The countershaft spindle is driven by a clutch to a live spindle, thereby relieving the strain from the live spindle.

Fountain, Drinking, Ice-Cooled, Economizer
Manufacturing Equipment and Engineering Co., Boston, Mass.
"American Machinist," June 9, 1921

The principal feature of the device is the fact that two coils and two cooling compartments are used. One of these cooling compartments with a coil immersed in it is cooled by ice, while the other is cooled by the water which is ordinarily wasted during drinking and which has been thoroughly cooled. The combined length of copper coils carrying the drinking water is 105 ft. This waste water circulates about the lower or primary coil. Either inclined or vertical-stream types of blubber can be furnished. The device has a cork-insulated cover, an air chamber surrounding the tank, and large connecting pipes.

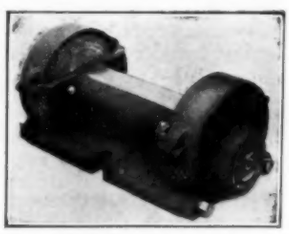
Handle, File, "Shur-Grip."
Parker Supply Co., 785 East 135th St., New York, N. Y.
"American Machinist," June 9, 1921

The principal feature of this handle is a case-hardened steel thread in the file opening, into which the tang of the file is screwed. This thread is said to cut into the tang as does a die and to hold the file absolutely rigid, not only eliminating the usual troubles of keeping the holder on the file, but making it possible to use the holder on different files. A steel casing around the thread prevents it from turning or expanding. This casing and thread are held in by a steel ferrule which covers the end of the holder. The grip is of hardwood. The handle is made in three sizes, for use with files from 6 to 18 in. long.

Boring Machine, (Re-), Cylinder, Keeler
Central City Machine Co., Syracuse, N. Y.
"American Machinist," June 9, 1921

The machine is for use in garages and repair shops for reboring automobile cylinders and is built on an angle plate intended to be secured to the top of the cylinder block. It is motor driven, and when in use there is no necessity for removing the engine from the automobile. Three cutter heads are furnished to bore from 2⅞ to 4¼ in. Each head has five high-speed steel cutters centrally adjustable by means of a five-lobed cam, so that any account of over-size can be obtained for any size of cylinder. The bottom of the cutter head is slightly conical, so that the head can be centered in the cylinder bore before the machine is clamped in place. An adjustable stop is provided, to stop the motor when the cutter head has reached a predetermined depth.

Truing Machine, Grinding Wheel, No. 23
Precision Truing Machine and Tool Co., Cincinnati, O.
"American Machinist," June 9, 1921

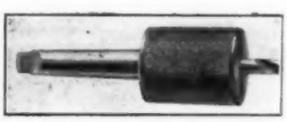


The machine is similar to the Precision No. 21 machine, but is made for larger grinders such as the Blanchard and Norton surface grinders with wheels up to 6-in. face. The machine carries wheels 4 in. in diameter with 1-in. face. The wheels when not in use, are thoroughly protected by hinged wheel guards, as shown. Two different grades of wheels can be carried at the same time, making it possible to use one machine on a number of surface grinding machines when different classes of finish are required; or one wheel can be used for roughing and the other for finishing the same grinding wheel. The machine is equipped with ball bearings.

Table, Cut-Off, Swing Saw
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," June 9, 1921

The table is designed for use with an overhead swing cut-off saw and is 16 ft. long, 19½ in. wide and 30 in. high. The top is made of kiln-dried maple with angle-iron girths and the legs are cast iron. The table is composed of two parts or sections. On the rear of the right-hand section is mounted the scale rail, which is graduated in eighths of an inch up to 96 in. On the left hand section is mounted the No. 419 automatic swing cut-off saw gage, which comprises a square rod graduated in eighths of an inch up to 96 in. Four automatic malleable-iron stops, one center and two end door-holders are mounted in place. The bed of the table carries a set of rollers. A dust chute is fastened between the two sections of the table.

Chuck, Drill, Automatic
Eastern Tube and Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
"American Machinist," June 9, 1921



This drill chuck is for use with straight-shank drills. The shank of the drill is held between three cam-shaped rollers, by the simultaneous rotation of which the size of the space for the drill shank can be varied. It is possible for the operator to change the drill while the spindle of the machine in which the chuck is fastened is rotating. The cam rollers automatically rotate so as to grip the work. The chuck is said to be self-centering and to be very rapid in its action. The presence of oil in the chuck does not prevent the securing of a strong grip. Morse taper shanks either Nos. 1, 2 or 3, are ordinarily furnished. The chuck is made in two sizes. The No. 6 size having a range from ⅛ to 25/64 in., and the No. 8 from 7/64 to 33/64 in.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Mass., Lowell—The Lamson Co., 196 Walker St., manufacturer of carrier tubes, A. W. De Camp, Genl. Supt.—$30,000 worth of machine tools for proposed plant at Eastwood, N. Y.

N. J., Newark—Lindeny Metal Novelty Wks., 15 Boyden Pl.—three Zeh & Hahremann No. 3 and 4 power presses.

N. J., Trenton—Crescent Insulated Wire & Cable Co., Olden and Taylor Sts.—machinery and tools.

N. Y., Buffalo—The Fisher Knitting Co., 1043 Jefferson St., M. J. Fisher, Purch Agt. —machine shop equipment. including lathes, milling machine, drill press, etc.

N. Y., Buffalo—Hyde Electric Service, 1474 Main St.—small bench lathe.

N. Y., New York—The Bd. Educ. will take bids on 2,600 items of machinery.

N. Y., New York—J. S. Mertins, 359 Pearl St.—one shaper with 16 in. stroke.

Pa., Easton—The Nash Sales and Service Co., 728 Wolff St., L. A. Snyder, Master Mechanic—machine to clamp on head for regrinding cylinder bores.

Pa., Hazleton—The Automatic Products Co., Hazleton—

One turret lathe, wire feed, 2 in. capacity with power feed to cross slide and power feed to turret.

One 4 in. or 6 in. spindle drill press for drilling up to 9/16 in. diameter in soft steel with individual feed and speed to each spindle.

One 6 in. circular cold saw for cutting off bar stock.

One small 2 spindle high-speed drill press, either ball-bearing or plain or single spindle drill press, high speed with cluster-box attachment so 2 or 3 size drills can be used at once.

Ala., Birmingham—G. R. Mueller Co., Brown Marx Bldg., C. R. Mueller, Purch. Agt.—

One belt or motor driven shear for cutting 1¼ in. round steel bars. Alligator shear not wanted as machine is to be used for cutting above and smaller size bars in quantities to specific lengths.

One belt or motor driven punch, capacity 1 in. hole in 1 in. plate or heavier, having not less than 36 in. throat. (Used if in good condition.)

Fla., Orlando — The Southern Cement Block Machine & Supply Co., Hughey and Silvia Sts., H. G. Lindsay, Secy. and Treas. —drills, milling machines, hack saw blades, planers, emery wheels, planers tools, nuts, bolts, etc.

Ga., Rome—The Bowie Stove Co.—complete machinery for stove foundry.

Ga., Thomasville—W. J. Barnett Boiler Wks., W. J. Barnett, Purch. Agt. — one radial drill, Morris or Fosdick, with 3 ft. or 30 in. arm, want most up-to-date machine made, (will consider used).

Ky., Louisville — The Progressive Auto Service Co., 207 West Bway., L. H Prescott, Genl. Mgr.—will be in the market about Jan. 1 for complete equipment for garage to house about 150 machines, also equipment and machinery for large automobile repair shop.

La., New Orleans — The Orleans Steel Products Co., Inc., 1021-25 Bienville St., P. O. Box 274.—one Jones & Lamson or equal, 2 or 2½ in. x 26 in. turret lathe, latest model (used).

La., New Orleans—F. A. Smith & Co., 538 Camp St., manufacturer of mechanical instruments, No. 1 or 1½ milling-machine with complete equipment, dividing head, etc., and a No. 3 inclinable punch press, (new or used).

N. C., Wilmington—Carters Production Wks., 210 South Water St., O. Carter, Mgr. —complete machinery for small cabinet shop and equipment for light machine shop including knife grinder, etc.

N. C., Winston-Salem—Ferguson Armature Wks., 125 West 8th St.—one lathe, 12 or 14 in. swing, about 8 ft. bed direct motor driven (used if in good condition).

S. C., Charleston—J. H. Roberts, 211 Spring St.—complete tools and machinery for the manufacture of geometric squares.

Tenn., Memphis—Millin Drug. Co., 89 North 2nd. St., M. M. Martin, Mgr.—complete machinery and equipment for the manufacture of metal out-door advertising signs.

Va., Norfolk—The Tidewater Glass Mfg. Corp., J. L. Welton, Pres., will receive bids until Nov. 1 for 18 in. drill press, 8 ft x 18 in. modern type lathe, 500 ft. 50 lb. pressure air compressor, air fan with 36 in. outlet or about 30,000 ft.

W. Va., Logan—Guyan Machine Shops, B. Shell, Mgr.—combined slitting shear and punch for ½ in. plate, steel frame, 220 volt, 3 ph., 60 cycle, motor driven.

Ill., Chicago—C. Fabri, 600 North Dearborn St.—tinners steel brake.

Ill., Chicago—G. Hohn, 2513 South Robey St.—bending and pipe threading machines.

Ill., Dixon—Reynolds Wire Co.—20 ft. x 10 in. engine lathe, milling machine, and bolt threader.

Ill., Waukegan—Wayvell, Chappell & Co. punch press with 6 in. stroke and 24 in. between pilkars.

O., Cleveland—The Co-operative Machine Co., 113 St. Clair Ave.—punch press, 3,500 to 4,000 lbs., 6 in. stroke, plain or geared.

O., Columbus—C. T. Dunkle Motors Co., 4th and Gay Sts.—complete equipment for proposed service station.

Wis., Baraboo—H. H. Mueller, Baraboo—lathes, several ton presses, etc.

Wis., Hingham—P. Eernisse & Co. (garage)—repair shop machinery.

Wis., Madison — T. Roster & Co., 440 Clemons Ave.—drill press.

Wis., Milwaukee—The Amer. Toy Shop, 435 Grove St., A. Banse, Purch. Agt.—small size iron shaper.

Wis., Milwaukee — F. J. Hanson, 463 Lenox St.—two drill presses for auto repair work.

Wis., Milwaukee—S. T. Kotowski, 691 Mitchell St.—lathe suitable for auto repair work.

Wis., Milwaukee—The Milwaukee Sheet Metal Wks., 226 Reed St., A. Meyer, Purch. Agt.—One 30 in. or 36 in. square shear, gutter beaters and sheet metal tools.

Wis., Milwaukee—The Milwaukee Electrical Wks., Inc., 315 Mineral St., W. Krist, Purch. Agt.—one lathe and probably a drill press.

Wis., Milwaukee—Pauly-Marx Co., 2530 North Ave.—lathe, drill press and emery wheel for garage.

Wis., Milwaukee—J. H. Tice, 2319 Lisbon Ave.—lathe and drill press for garage.

Wis., Oshkosh—Green & Negendank, Nebraska St.—lathe and other equipment for automobile repair work.

Minn., Minneapolis—S. A. Otness, 4009 12th Ave., S.—new or second hand pipe bending machine.

Tex., Harrisburg—The Harrisburg Machine Wks., Inc., F. D. French, Secy. and Treas.—one 3 ft. radial drill, one 250 or 300 lb. trip hammer, and one bolt cutting machine up to 1¼ in.

Que., Montreal—L. Britton, 980 St. Denis St.—complete equipment for auto repair shop at 971-73 St. Christopho St.

Australia, Sidney — The Victorian Railways Co.—Duplex locomotive rod boring machine.

N. Y., Buffalo—L. A. Maier, 339 Landon St.—perforating machine for perforating art needle work patterns, Julius Sternfeld make preferred.

Pa., Philadelphia—Brownhill & Kramer, c/o H. A. Brownhill, 406 Memphis St.—new knitting machines.

Pa., Philadelphia — Queens-Brooks Co., c/o J. S. Queens, American and Diamond Sts.—general knitting machinery.

Ga., Macon—Central Sash & Door Co., T. M. Willingham, Secy. and Treas.—machines for the manufacture of sash and doors.

N. C., Hamlet—The Chamber of Commerce, J. F. Moffet, Mgr. — complete machinery and equipment for cotton mill.

Va., Mt. Crawford—J. S. Dovel—cut-off saw suitable for dado work, on which arbor slides up to work on level plant, (used).

Ill., Chicago—The Chicago Metallic Mfg. Co., 542 West 35th St., manufacturer of electric appliances—power scrap-tin baling machine.

Mich., Detroit—Beaubien Ice & Coal Co., 4205 West Jefferson Ave.—equipment for making ice.

Mich., Detroit—J. Tekieli, 9201 Home St. —one portable saw mill complete, (used).

O., Columbus—The Central Tablet Mfg. Co., Harvard Ave., D. A. Heffner, Genl. Mgr.—six ruling machines, 6 cutters and other equipment for proposed addition to plant.

Wis., Beaver Dam—R. F. Clark, special machinery for proposed canning factory at Fox Lake.

Wis., Clayton — J. Rothenbuhler — belt driven machinery for making cheese.

Wis., Eau Claire—Eau Claire Wood Products Co., Wilson and Gilbert Sts., S. R. Davis—wood-working machinery to manufacture wooden specialties and wood work.

Wis., Fox Lake—R. F. Clark, Beaver Dam, and G. Otto, Randolph—power driven machinery for corn and pea cannery here.

Wis., Janesville—Brittingham & Hixon Lumber Co., 314 West Milwaukee St.—wood-working machinery.

Wis., Manitowoc—The Brewer Mfg. Co., Meadow Lane, manufacturers of pianos, cabinets, etc.—woodworking machinery for proposed factory.

The Weekly Price Guide

This Week's Market

Structural steel shapes are quoted at the Pittsburgh mill at $1.60@$1.75; plates at $1.55@$1.65 and soft steel bars at $1.50@$1.65 per 100 lb. Mill shipments, New York, of shapes and plates are quoted at $1.98@$2.13; bars at $1.98@$2.03 per 100 lb. Chicago warehouses report a reduction of ½c. in cold rolled strip steel and 2c. per lb. in light spring steel. New York quotes cold finished shafting at $3.88 as against $4.03 and cold drawn flats, squares, etc., at $4.38 as compared with $4.53 per 100 lb. formerly.

Electrolytic copper and tin have both advanced ¼c. per lb. in New York. Brass sheets and rods have advanced 1c. per lb. in New York and Chicago warehouses. Aluminum ingots are quoted at 20c. as against 21c. per lb. in Chicago. Cleveland reports a rise of 1c. in copper sheets, wire, bars and tubing and advances ranging from ½c. to 1½c. per lb. in old metals.

Linseed oil is down 8c. per gal. in Cleveland, to 80c.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.50
Northern Basic	22.52
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	30.26
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.75
Virginia No. 2	28.74
Basic	20.75
Grey Forge	21.75
CHICAGO	
No. 2 Foundry local	22.70
No. 2 Foundry, Southern, sil 2.25@2.75	26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.96
Basic	21.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3.38
No. 12	2.60	3.33	3.15	3.43
No. 14	2.70	3.38	3.20	3.48
No. 16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	4.05	3.55	3.95
Nos. 22 and 24.	2.90	4.10	3.60	4.00
Nos. 25 and 26.	2.95	4.15	3.65	4.05
No. 28	3.00	4.25	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.25	3.75	4.15
Nos. 12 and 14.	3.10	4.35	3.85	4.25
Nos. 17 and 21.	3.40	4.65	4.15	4.55
Nos. 22 and 24.	3.55	4.80	4.30	4.70
No. 26	3.70	4.95	4.55	4.85
No. 28	4.00	5.25	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	68½	56	¾ to 1½	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2½ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to 8	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	46%	60½%	47½%	68½%	56%
3½ to 6 in. steel lap welded	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	*3.78
Spring steel (light)	6.00	6.00	†8.50
Coppered Bessemer rods(base)	8.00	8.00	*6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	6.75
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	3.88	3.50	4.00
Cold finished flats, squares	4.38	4.00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (2.15@2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire ..... New York $\frac{3}{32}$, 8½c. per lb.; ¼, 7.15c.; $\frac{5}{32}$ to ½, 6.75c. Swedish iron sells at 9c. per lb. in Chicago. *Price to dealers. †Carriage spring steel.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.62½
Tin, 5-ton lots, New York			27.50
Lead (up to carlots), St. Louis, 4.60; New York			5.00
Zinc (up to carlots), St. Louis, 4.97½; New York			5.37½
	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25.00	20.00
Antimony (Chinese), ton spot	5.50	6.00	6.50
Copper sheets, base	20.75	21.50	20.50
Copper wire (carlots)	16.50	16.50	15.50
Copper bars (ton lots)	19.00	23.00	18.00
Copper tubing (100-lb. lots)	20.50	23.00	20.50
Brass sheets (100-lb. lots)	16.25	16.00	16.25
Brass tubing (100-lb. lots)	18.00	18.00	18.00
Brass rods (1,000-lb. lots)	14.25	16.00	14.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ¼), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	37.50	32.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	10.50	9.50
Copper, light, and bottoms	8.00	8.00	8.25
Lead, heavy	4.00	3.75	3.75
Lead, tea	3.00	2.75	3.00
Brass, heavy	6.50	6.00	8.00
Brass, light	5.00	4.00	4.75
No. 1 yellow brass turnings	5.25	4.50	5.25
Zinc	3.00	2.00	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	21 50	.....	.....
IX,	20x28, 112 sheets	24.00	.....	.....
IXX,	20x28, 56 sheets	13.75	.....	.....
IXXX,	20x28, 56 sheets	15.50	.....	.....
IXXXX,	20x28, 56 sheets	17.00	.....	.....
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	18.50	.....	.....
IX,	20x28, 112 sheets	21.50	.....	.....
IXX,	20x28, 56 sheets	12.25	.....	.....
IXXX,	20x28, 56 sheets	14.00	.....	.....
IXXXX,	20x28, 56 sheets	15.75	.....	.....
Coke Plates, Bright				
Prime, 20x28 in.:			(56 sheets)	
80-lb,	112 sheets	13 60	.....	.....
90-lb.,	112 sheets	13.80	.....	.....
100-lb.,	112 sheets	14 00	6.50	.....
IC,	112 sheets	14 30	6.65	.....
IX,	112 sheets	16.30	.....	.....
IXX,	56 sheets	9 15	.....	.....
IXXX,	56 sheets	10.15	.....	.....
IXXXX,	56 sheets	11 15	.....	.....
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.50	6.25	6.25
IC,	14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	—50%	—60%	—60-5%
1⅛ and 1¼x3 in. up to 12 in	—40%	60-10-10%	—55%
With cold punched sq. nuts	—30%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	.....
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	.....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	.....	.....
Lag screws, coach screws	—50–10%	.....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	.....	.....
Tap bolts, hex. heads	—20%	.....	.....
Rivets, 7/16 in. dia. and smaller. *New list*	-50-10%	60-10-10%	-60-10%
Rivets, tinned	-50-10%	60-10-10%	4½c. per lb. net
Semi-finished nuts, all sizes	—70%	75%	75%
Case-hardened nuts	—60%	.....	.....
Washers, cast iron, ⅜ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3 00	.....	.....
Nuts, hot pressed, sq.	Off list	2.00	3.00	3.00
Nuts, hot pressed, hex	Off list	2 00	3.00	3.00
Nuts, cold punched, sq	Off list	1.50	3 00	3.00
Nuts, cold punched, hex	Off list	1.50	3.00	3.00
Rivets:				
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb		$3.70	3.50	3 68
Cone heads, ditto		3 80	3.60	3.78
1⅛ to 1¾-in. long, all diameters, *EXTRA* per 100 lb		0.25	.....	....
⅞ in. diameter	*EXTRA*	0.15	.....	....
½ in. diameter	*EXTRA*	0.50	.....	....
1 in. long, and shorter	*EXTRA*	0.50	.....	....
Longer than 5 in	*EXTRA*	0.25	.....	....
Less than 200 lb	*EXTRA*	0.50	.....	....
Countersunk heads	*EXTRA*	0.35	.....	....
Copper rivets		50–10%	40–10%	40%
Copper burs		25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0 12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	.....	55.00	55.00
Wiping cloths per M., 13¼x20½	.....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.73	.80	.81
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb		.80	.80
Coke, prompt furnace, Connellsville	per ton	$3.35@3.50	
Coke, prompt foundry, Connellsville	per ton	4.25@4.75	

Wis., Milwaukee—The Great Lakes Shoe Co., c/o A. K. Stebbins, 81 Michigan St.—power driven shoe making machinery.

Wis., Milwaukee—The Quality Dairy Co., 2437 Hadley St.—refrigeration and dairy machinery.

Wis., Milwaukee—F. Rosenberg Elevator Co., 174 Reed St.—1½ ton cranes.

Wis., Oconomowoc — E. Otto — mortiser and saws for wood-working plant.

Wis., Rib Lake—The Rib Lake Chair & Mfg. Co.—wood-working machinery for the manufacture of chairs.

Wis., Slinger—The Storck Products Co. ice cream making and refrigerating machinery, for branch plant at Beaver Dam.

Mo., Deepwater—The W. S. Dickey Mfg. Co.—machinery and tools for making tile.

Mo., Rockville—The Keystone Products Co., T. A. Finley, Pres.—$2,000 worth of equipment for its soap factory at Joplin.

Mo., St. Louis—The Bd. Educ., c/o C. P. Mason, Secy., Bd. Educ. Bldg.—manual training equipment for proposed junior high school on Hartford and Wyoming Sts.

Mo., St. Louis—Larkin & Pratt, 676-78 Arcade Bldg.—machinery for making syrup, capacity 400 tons of cane per hour.

Tex., Marshall—The Marshall Office Supply Co., 107½ West Austin St., G. W. Duryea, Pres.—complete renickeling outfit for small parts.

Tex., Rotan—The Patton Cement Plaster Co., J. W. Patton, Pres.—complete machinery and equipment for the manufacture of plaster (latest models).

Tex., Waco—Circle A Corp. of America, R. S. Lazenby, Pres.—refrigerating, syrup making, water distilling and bottle washing machinery for carbonated beverages also machinery to carbonate beverages.

Metal Working Shops

NEW ENGLAND STATES

Conn., Stamford — Steinmetz & Levine, Archts., Gurley Bldg., are receiving bids for the construction of a 1 story, 75 x 154 ft. garage, etc. on Grove St., for the Mathison Motor Sales So. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

Pa., Philadelphia—The Bureau of Public Wks., City Hall, will soon award the contract for the construction of a 1 story, 61 x 108 ft. garage and machine shop. Estimated cost, $60,000. H. B. Sinkler, City Hall, Archt.

Pa., Philadelphia—M. O'Malley, 818 North 16th St., will receive bids until Oct. 25, for the construction of a 1 story, 40 x 140 ft. garage at 1522-24 Parrish St. Estimated cost, $45,000.

Pa., Pittsburg—A. Schmitz, Penn Ave., has awarded the contract for the construction of a 1 story garage on Penn Ave. Estimated cost, $50,000.

SOUTHERN STATES

Ga., Rome—The Bowie Stove Co., manufacturer of ranges, cook stoves, heaters, grates, country hollow-ware, stove hollow-ware, etc., plans to rebuild its plant which was recently destroyed by fire. J. M. Berry, Pres.

MIDDLE WEST STATES

Ill., Sterling—P. W. Kempster will build a 1 story, 50 x 142 ft. garage. Estimated cost, $40,000. Noted Oct. 13.

Ill., Zion—Zion Institutions & Industries, c/o W. H. Clendinnen, Administration Bldg., will build a 1 story, 100 x 140 ft. garage. Estimated cost, $50,000. Noted Oct. 13.

O., Cleveland—R. B. Mehling Co., 1269 East 105th St., is having plans prepared for the construction of a 2 story, 70 x 120 ft. garage and commercial building on Hayden Ave. near Woodward Rd. Estimated cost, $60,000. Private plans.

O., Cleveland—Tenfel Bros., 3317 West 65th St., have awarded the contract for the construction of a 1 story, 40 x 81 ft. garage on West 65th St. Estimated cost, $40,000.

O., Columbus—C. T. Dunkle Motors Co., 4th and Gay Sts., plans to build a 4 story, 125 x 136 ft. service station in downtown district.

Wis., Baraboo—H. H. Mueller, Baraboo, is having plans prepared for the construction of a 2 story, 60 x 85 ft. garage on Main St. Estimated cost, $50,000. E. Tough, 24 East Mifflin St., Madison, Archt.

Wis., Milwaukee—Hanson & Phillips, Kinnickinnic and Logan Aves., have awarded the contract for the construction of a 1 story, 100 x 100 ft. garage on Kinnickinnic Ave. Estimated cost, $40,000. Noted Oct. 13.

Wis., Milwaukee—Kohn Mfg. Co., 3513 North Ave., manufacturer of incinerators, will build a 1 story, 30 x 60 ft. factory on 30th St. Estimated cost, $9,000.

Wis., Milwaukee — The Lincoln Investment Co., c/o H. J. Esser, Archt., 82 Wisconsin St., has awarded the contract for the construction of a 1 story, 80 x 132 ft. garage on Keefe Ave. Estimated cost, $40,000.

Wis., Milwaukee—Stearns Sales Agency, 156 Farwell Ave., plans to construct a 2 story, 50 x 150 ft. garage. Estimated cost, $70,000. Architect not selected.

WEST OF THE MISSISSIPPI

Col., Denver—The Denver Auto Hotel Co., Central Savings Bank Bldg., is having plans prepared for the construction of a 6 story, 100 x 125 ft. garage on Lawrence St. between 14th and 15th Sts. Estimated cost, $150,000. W. W. Bowman, Central Savings Bank Bldg., Archt.

Ia., Davenport—The Crane Co., c/o W. T. Cotter, Mgr., 600 East 4th St., has awarded the contract for the construction of a 3 story factory for the manufacture of plumbing supplies. Estimated cost, $85,000. Noted Jan. 20.

Mo., Clarence—A. Burnett, c/o Clarence Auto Co., will build a 1 story, 100 x 140 ft. garage. Estimated cost, $50,000. Noted Sept. 8.

Mo., St. Louis—A. S. Alschuler, Archt., 28 East Jackson Blvd., Chicago, Ill., will receive bids until Oct. 25 for the construction of a 1 story, 199 x 331 ft. garage on 15th and Walnut Sts., for S. Simon, c/o Williams & Bland, 717 Chestnut St. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND STATES

Mass., Douglas—Haywood Woolen Co. is having plans prepared for the construction of a 1 story, 50 x 80 ft. factory addition. Estimated cost $25,000. C. T. Main, 201 Devonshire St., Boston, Mass.

MIDDLE ATLANTIC STATES

Pa., Harrisburg—The School Bd., 121-23 Chestnut St., will receive bids until Oct. 24 for the construction of a 3 story, 100 x 100 ft. high school including technical departments and shops. Estimated cost, $150,000. D. D. Hammelbaugh, Secy.

Pa., Morrisville—The Robertson Art Tile Co. has awarded the contract for the construction of a 2 story,, 50 x 100 ft. addition to its factory. Estimated cost, $20,000.

Pa., Philadelphia—Brownhill & Kramer, c/o H. A. Brownhill, 406 Memphis St., have awarded the contract for the construction of a 3 story, 80 x 80 ft. addition to their factory on Memphis St., for the manufacture of hosiery. Estimated cost, $60,000.

Pa., Philadelphia—Queens-Brooks Co., c/o J. S. Queens, American and Diamond Sts., manufacturer of knitting goods, has awarded the contract for the construction of a 5 story, 55 x 200 ft. factory on 5th St. and Huntington Park Ave. Estimated cost, $150,000.

MIDDLE WEST STATES

Mich., Detroit—Beaubien Ice & Coal Co., 4205 West Jefferson Ave., has awarded the contract for the construction of a 1 story ice plant on Baker and Porter Sts. Estimated cost, over $40,000.

O., Cleveland—Pavelka Bros., 2978 East 37th St., manufacturers of sausage, are receiving bids for the construction of a 1 story, 57 x 65 ft. addition to their factory on 37th St. and Bway. Estimated cost, $40,000.

O., Columbus—The Central Tablet Mfg. Co., Harvard Ave., has awarded the contract for the construction of a 2 story, 75 x 100 ft. factory on Harvard Ave. and N. & W. Railroad. Estimated cost, $24,180.

Ill., Centralia—The Chicago, Burlington & Quincy R.R., 542 West Jackson Blvd., Chicago, will receive bids until Oct. 25 for the construction of a 1 story round house, 105 ft. long, and coal chute with mechanical operated machinery, here. Estimated cost, $125,000. W. T. Kuausch, c/o owner, Archt.

Ill., Chicago—Bronson—Canode Printing Co., 626 Federal St., plans to build a 5 story, 50 x 142 ft. printing plant on Washington and Elizabeth Sts. Estimated cost, $150,000. Architect not selected.

Ill., Chicago — Hinckley & Schmitt, 418 West Ontario St., have awarded the contract for the construction of 2 additional stories to their bottling plant. Estimated cost between $75,000 and $100,000.

Ill., Momence—The Merit Tent & Awning Co. plans to build a 2 story factory. Estimated cost, $50,000. Architect not seletced.

Ill., Peoria — The Bd. Educ., c/o G. Mitchell, will receive bids until Nov. 5 for the construction of a 2 story manual training school. Estimated cost, $225,000. F. J. Klein, 331 Main St., Archt. Noted April 21.

Wis., Fox Lake — R. F. Clark, Beaver Dam, plans to build a 2 story, 60 x 85 ft. canning factory on Main St., here. Estimated cost, $45,000. Architect not selected, probably private plans.

Wis., Madison—The University of Wisconsin has awarded the contract for the construction of an addition to its service building and electric sub-station. Estimated cost, $66,366. Noted Oct. 13.

Wis., Manitowoc—The Brewer Mfg. Co., Meadow Lane, has awarded the contract for the construction of a 1 story, 60 x 30 ft. factory for the manufacture of pianos, cabinets, optical fitting tables, etc. Estimated cost, $50,000.

Wis., Milwaukee — The Amer. Hide & Leather Co., 658 Commerce St., plans to rebuild its tannery which was recently destroyed by fire. Estimated loss, $1,500,000. Architect not selected.

Wis., Milwaukee—C. Kalinowski, 1178 7th Ave., has awarded the contract for the construction of a 2 story bakery on 8th Ave. Estimated cost, $40,000.

Wis., Milwaukee—The National Distilling Co., 27th and St. Paul Ave., has awarded the contract for the construction of a 1 story, 35 x 40 ft. addition to still house on 27th St. Estimated cost, $12,000.

Wis., Milwaukee—The Quality Dairy Co., 2437 Hadley St., is having plans prepared for the construction of a 1 story, 20 x 70 ft. addition to its dairy. Estimated cost, $15,000. H. W. Voelz, 86 Michigan St., Archt.

WEST OF THE MISSISSIPPI

Ia., Des Moines — Mennig-McCord, East 26th St. and Dean Ave., have awarded the contract for the construction of a 3 story, 42 x 180 ft. pickle factory at 2553 Dean Ave. Estimated cost, $55,000.

Minn., Minneapolis—The Strutwear knitting Co., 731 East 14th St., is having plans prepared for the construction of a 5 story, 160 x 250 ft. factory on 11th Ave., S. and 6th St. Estimated cost, $200,000. W. A. Strutwear, Secy. Long, Lamoreaux & Thorshov, 1028 Andrus Bldg., Archts.

Minn., Red Wing—W. F. Zimmerman is interested in a syndicate which plans to build a vinegar factory. Estimated cost, $150,000. Architect not announced.

Mo., Deepwater—The W. S. Dickey Mfg. Co. plans to build a 3 story addition to its glazed tile factory. Estimated cost, $20,000. Architect not selected.

Mo., Joplin—The Keystone Products Co., Rockwell, plans to convert a 1 story building on 10th and Main Sts., here, into a soap factory. Estimated cost, $5,000. T. A. Finley, Pres.

Mo., Kansas City—The Artzcraft Broom Co., 1423 Kansas Ave., is having plans prepared for the construction of a 2 story, 65 x 127 ft. factory on 14th St. and Kansas Ave. Estimated cost, $75,000. C. A. Smith, Finance Bldg., Archt.

Okla., Oklahoma City—The Smith Baking Co., 437 Oak St., has awarded the contract for the construction of a 2 story, 100 x 150 ft. bakery on 39th and Oak Sts. Estimated cost, $150,000. Noted Sept. 29.

Mo., Salisbury—The Salisbury Sanitary Ice & Supply Co., will receive bids until Oct. 26 for the construction of a 2 story ice plant. Estimated cost, $50,000. Black & Co., Salisbury, Archts.

WESTERN STATES

Cal., Los Angeles—Swift & Co., 922 East 1st St., has awarded the contract for the construction of a packing plant. Estimated cost, $52,000. Noted Aug. 1.

CANADA

Que., Montreal — The Molsons Brewery, 906 Notre Dame St., E., has awarded the contract for the construction of a 4 story brewery on Notre Dame St., E. Estimated cost, $144,800. Noted Oct. 6.